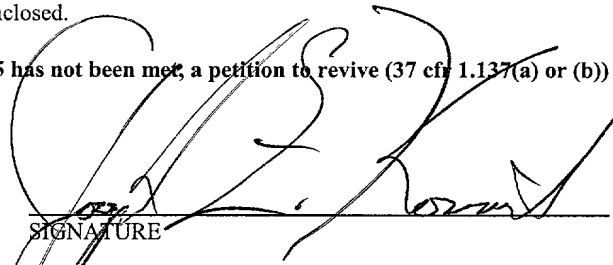


FORM PTO-1390 (REV 10-95)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEYS DOCKET NO.  3699-2-PUS	
		U.S. APPLICATION NO. (If known, see 35 CFR 1.5) <div style="font-size: 1.5em; font-weight: bold;">09/646141</div>	
INTERNATIONAL APPLICATION NO.  PCT/US97/08842	INTERNATIONAL FILING DATE  05 June 1997	PRIORITY DATE CLAIMED  14 March 1997	
TITLE OF INVENTION <div style="text-align: center;">"COPY PROTECTABLE OPTICAL MEDIA DEVICE AND METHODOLOGY THEREFOR"</div>			
APPLICANT(S) FOR DO/EO/US <div style="text-align: center;">McLAUGHLIN et al.</div>			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))           <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> has been transmitted by the International Bureau</li> <li>c. <input checked="" type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li>6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).           <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> have been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input checked="" type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li>10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol>			
<b>Items 11. To 16. below concern documents or information included:</b>			
<ol style="list-style-type: none"> <li>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.23 and 3.31 is included.</li> <li>13. <input type="checkbox"/> A FIRST preliminary amendment.</li> <li>14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</li> <li>15. <input type="checkbox"/> A substitute specification.</li> <li>16. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>17. <input checked="" type="checkbox"/> Other items or information:           <div style="margin-left: 20px;">             Petition to Correct an Obvious Error and to              Revive an Unintentionally Abandoned Application           </div> </li> </ol>			
"EXPRESS MAIL" MAILING LABEL NUMBER: EL417658322 DATE OF DEPOSIT: September 13, 2000  I HEREBY CERTIFY THAT THIS PAPER OR FEE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER 37 CFR 1.10 ON THE DATE INDICATED ABOVE AND IS ADDRESSED TO THE ASSISTANT COMMISSIONER FOR PATENTS, BOX PCT, WASHINGTON, D.C. 20231.			
TYPED OR PRINTED NAME: <u>JANICE MESSER</u>			
SIGNATURE: <u><i>Janice Messer</i></u>			

U.S. APPLICATION NO. (if known, see 37 CFR 1.51) <b>09/646141</b>		INTERNATIONAL APPLICATION NO. PCT/US97/08842		ATTORNEY DOCKET NUMBER 3699-2-PUS	
17. <input checked="" type="checkbox"/> The following fees are submitted:  <b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):</b>  Search Report has been prepared by the EPO or JPO ..... \$840.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... \$670.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... \$760.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid USPTO ..... \$970.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... \$96.00  <div style="text-align: right;"><b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b></div>				CALCULATIONS      PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than [ ] 20 [X] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$ 130.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	42 - 20 =	22	x \$18.00	\$ 396.00	
Independent Claims	21 - 3 =	18	x \$78.00	\$ 1,404.00	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)			+ \$260.00	\$	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$ 2,026.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37i CFR 1.9, 1.27, 1.28).				\$	
<b>SUBTOTAL =</b>				\$	
Processing fee of \$130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
<b>TOTAL NATIONAL FEE =</b>				\$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) \$40.00 per property				\$ 40.00	
<b>TOTAL FEES ENCLOSED =</b>				\$ 2,066.00	
				Amount to be: refunded	\$
				charged	\$
a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>2,066.00</u> to cover the above fees is enclosed.  b. [ ] Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.  c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-1970. A duplicate copy of this sheet is enclosed.					
<b>NOTE: Where an appropriate time limit under 37 cfr 1.494 or 1.495 has not been met, a petition to revive (37 cfr 1.137(a) or (b)) must be filed and granted to restore the application pending status.</b>					
SEND ALL CORRESPONDENCE TO:  SHERIDAN ROSS P.C. 1560 Broadway, Suite 1200 Denver, Colorado 80202-5141 Telephone: (303) 863-9700 Facsimile: (303) 863-0223					
 SIGNATURE Joseph E. Kovarik Registration No. 33,005					

## FIELD OF INVENTION

Variable	Mean	Standard Deviation	Minimum	Maximum
Age	34.5	10.5	20	55
Gender	0.5	0.5	0	1
Marital Status	0.5	0.5	0	1
Education	12.5	1.5	10	15
Income	3500	1500	1000	6000
Health	0.5	0.5	0	1
Smoking	0.2	0.4	0	1
Drinking	0.1	0.3	0	1
Exercise	0.3	0.5	0	1
Stress	0.4	0.5	0	1
Sleep	0.5	0.5	0	1
Appetite	0.5	0.5	0	1
Mood	0.5	0.5	0	1
Energy	0.5	0.5	0	1
Concentration	0.5	0.5	0	1
Memory	0.5	0.5	0	1
Emotion	0.5	0.5	0	1
Behavior	0.5	0.5	0	1
Thought	0.5	0.5	0	1
Feeling	0.5	0.5	0	1
Perception	0.5	0.5	0	1
Attention	0.5	0.5	0	1
Intuition	0.5	0.5	0	1
Imagination	0.5	0.5	0	1
Reasoning	0.5	0.5	0	1
Logic	0.5	0.5	0	1
Analysis	0.5	0.5	0	1
Synthesis	0.5	0.5	0	1
Evaluation	0.5	0.5	0	1
Creation	0.5	0.5	0	1
Innovation	0.5	0.5	0	1
Discovery	0.5	0.5	0	1
Research	0.5	0.5	0	1
Experiment	0.5	0.5	0	1
Observation	0.5	0.5	0	1
Measurement	0.5	0.5	0	1
Calculation	0.5	0.5	0	1
Comparison	0.5	0.5	0	1
Classification	0.5	0.5	0	1
Organization	0.5	0.5	0	1
Management	0.5	0.5	0	1
Leadership	0.5	0.5	0	1
Communication	0.5	0.5	0	1
Interpersonal	0.5	0.5	0	1
Social	0.5	0.5	0	1
Community	0.5	0.5	0	1
Environment	0.5	0.5	0	1
Nature	0.5	0.5	0	1
World	0.5	0.5	0	1
Universe	0.5	0.5	0	1
Existence	0.5	0.5	0	1
Reality	0.5	0.5	0	1
Truth	0.5	0.5	0	1
Justice	0.5	0.5	0	1
Freedom	0.5	0.5	0	1
Equality	0.5	0.5	0	1
Peace	0.5	0.5	0	1
Love	0.5	0.5	0	1
Hope	0.5	0.5	0	1
Faith	0.5	0.5	0	1
Belief	0.5	0.5	0	1
Religion	0.5	0.5	0	1
Spirituality	0.5	0.5	0	1
Philosophy	0.5	0.5	0	1
Art	0.5	0.5	0	1
Music	0.5	0.5	0	1
Dance	0.5	0.5	0	1
Theater	0.5	0.5	0	1
Cinema	0.5	0.5	0	1
Literature	0.5	0.5	0	1
History	0.5	0.5	0	1
Science	0.5	0.5	0	1
Technology	0.5	0.5	0	1
Industry	0.5	0.5	0	1
Business	0.5	0.5	0	1
Politics	0.5	0.5	0	1
Law	0.5	0.5	0	1
Medicine	0.5	0.5	0	1
Education	0.5	0.5	0	1
Research	0.5	0.5	0	1
Development	0.5	0.5	0	1
Growth	0.5	0.5	0	1
Progress	0.5	0.5	0	1
Change	0.5	0.5	0	1
Transformation	0.5	0.5	0	1
Evolution	0.5	0.5	0	1
Revolutions	0.5	0.5	0	

The computer industry has long been plagued by the illegal misappropriation of software products. The Software Publisher's Association (SPA), an organization with devotes significant resources to tracking and analyzing piracy problems, has determined that in 1994 alone the personal computer software industry lost in excess of \$8 billion due to illegal copying of business application software. The SPA further estimated that virtually half of the business software in use in 1994 was pirated, and this estimate does not include the illegal copying of operating systems, education, entertainment or personal productivity software. The piracy problem is particularly acute in more developed markets such as the United States.

30 Many approaches have been implemented by software  
producers in an effort to combat piracy. Some of these  
approaches include encryption, special data formatting  
complex installation procedures, and passwords, to name  
only a few. Unfortunately, end user resistance to these  
35 anti-piracy schemes has been high because they are plagued

by one or more limitations, such as an inability to "try before you buy", restrictions on the generation of legitimate back-up copies, and password protection techniques which fail once the password is divulged or discovered. The inability of copy protection schemes to win end-user acceptance has been so extreme that many publishers have simply abandoned the effort, choosing instead to rely on the integrity of their customers to abide by copyright laws.

10       The misappropriation of software is rampant irrespective of whether the data storage medium is magnetic or optical. Magnetic storage disks are particularly susceptible to piracy. Commercially available magnetic disks, such as the conventional floppy disk, are read/write/erase memory devices in which data is stored in a magnetizable surface layer as discrete patterns of magnetism. Information is stored and retrieved by a read/write head which contains a coil wound around an iron core.

20       While the magnetic recording medium remains the most popular, there has been a growing trend in recent years to utilize an optical medium environment for the storage and retrieval of data. The reason for this trend is readily apparent. A commercially available magnetic floppy disk is only capable of storing 1.44Mb of data, whereas an optical CD-ROM of the same size can have a capacity in excess of 600Mb.

30       In a typical optical disk for use in a computer's optical readout system, data is stored as a series of lands and pits. This is accomplished by stamping along spiral tracks on a transparent plastic disk, overlaying this with a reflective coating, and thereafter superimposing a protective layer over this coating. Light from a semiconductor laser is focused onto either the lands or pits from below and the reflected light impinges upon a



rewritten on, etc. many times, similar to a magnetic disk. A photochromic material, or chromophore, is attractive for this purpose. Photochromism is the phenomenon whereby the absorption spectrum of a molecule or crystal changes reversibly when the material is irradiated by light possessing certain wavelengths. Thus, for example, a colorless compound may change its molecular state to a quasi-stable colored state when radiated by ultraviolet (UV) light, yet be returned to the colorless state upon exposure to visible light. Both organic and inorganic materials which exhibit these properties have been known for years.

Recently, photochromic compounds have attracted much attention in the field of optical recording. As discussed in Jun'Etsu Seto, Photochromic Dyes, the photochromic materials initially studied for such an application did not have significant sensitivity in the infrared region near 800 nm, the wavelength region of conventional laser diodes. Seto recognizes, however, that a specific class of photochromic compounds, known as spiropyrans, can be manipulated to exhibit improved sensitivity in the infrared region. Specifically, Seto discusses a class of photochromic spiropyrans with benzothiopyran units in the molecular framework and concludes that the synthesized spirobenzothiopyran is well suited to the requirements of erasable optical recording media for systems using conventional laser diodes.

Another dye of the spiropyran class, having the chemical composition 6-nitro-1'3'3'-trimethylspiro[2H-1-benzothiopyran-2,2'-indoline], or 6-nitro-1-SBIPS for short, is discussed in Tarkka, Richard U., Talbot, Marc E., et al., "Holographic Storage in a near-ir sensitive photochromic dye", Optic Comm. 109, 54-58 (1994). This article discusses the use of 6-nitro-1-S-BIPS for use in the holography field wherein the dye becomes colored when

exposed to light having a wavelength of 780 nm. The film returns to a quasiclear state upon exposure to an ultraviolet light source at 337 nm.

It is anticipated, based on these recent developments, that the conventional magnetic disk will eventually become obsolete due to the recent developments in optical storage technology. Concurrent with this anticipated phaseout of magnetic disks will be a need to adequately address the piracy issues which have for so long plagued the software industry so that the illegal misappropriation of proprietary rights can be thwarted. Accordingly, while past research has concentrated on utilizing photochromic materials for the recording of information on compact disks, the present inventors have realized that similar photochromic materials may also be used to protect the compact disk against illegal copying and distribution. In addition, the present inventors have also recognized that certain other photoreactive materials, as well as oxygen reactive materials, may be employed for this purpose. That is, compounds such as these may be used to deny access to a specially coated compact disk beyond one or more authorized uses. That is, such compounds, when applied as a coating on a disk, operate to effectively change its light transmissive properties upon exposure to a low power reading laser, thereby darkening the coating on the disk and rendering data undetectable by an optical readout system. Moreover, the inventors have also recognized other optical media data protection techniques for the present invention that also address the unrestricted duplication of information as discussed hereinabove.

#### SUMMARY OF INVENTION

It is an object of the present invention to provide a new and useful optical medium, such as an optical disk, and system therefor which is adapted for use with an optical

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readout system of, for example, a computer, wherein the readout system includes a light source operative to produce an interrogating beam of light for reading data structures on the optical medium.

5 Another object of the present invention is to provide such an optical medium which is particularly adapted to prevent unrestricted access to encoded information thereon by an optical readout system, wherein the information may be, for example, graphical data, video data, audio data,  
10 text data, and/or a software program.

Another object of the present invention is to use the error detection capabilities of a conventional optical medium reader for: (a) determining a status of an optical medium provided by the present invention, and/or (b)  
15 verifying an object or person as authentic. That is, it is an object of the present invention to use the errors detected on the optical medium for (a) and/or (b) above. For example, the total number of errors detected in a predetermined area of the optical medium, the density of  
20 the errors detected in a predetermined location of the optical medium, and/or the pattern of errors in a predetermined area of the optical medium provides, according to the present invention, sufficient information for (a) and/or (b) above.

25 Another object of the present invention is to provide verification or authentication of information provided on or with the novel optical medium of the present invention. For example, the present invention may be used for verifying the authenticity of an optical disk having an  
30 audio and/or multimedia presentation thereon. Additionally, when the optical medium of the present invention is incorporated into, for example, a financial transaction card, the card can be verified as authentic.

Another object of the present invention is to provide  
35 verification or authentication of a user that is, for

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example, desirous of making an electronic financial transaction such as on the Internet.

A further object of the present invention is to provide a new and useful optical disk which is relatively  
5 easy to manufacture without substantial increases in costs.

Yet another object of the present invention is to provide a methodology of limiting access to information stored on an optical medium for use in a computer's optical readout system.

10 Still a further object of at least some embodiments of the present invention is to provide an optical disk which is particularly constructed so that an end user is unaware of the disk copy protection features until after they have been performed.

15 A first collection of embodiments of the present invention accomplishes these objectives by providing an article of manufacture (e.g., an optical disk) that is adapted to be encoded with data and further adapted so that duplication of the data by an optical scanning machine  
20 (i.e., an optical readout system) may be restricted. The article of manufacture comprises a substrate fabricated from a selected material, with a surface thereof provided with the data. A reactive compound is formed as a coating on at least a portion of the substrate surface and the  
25 reactive compound operates to change from an optically transparent state to an optically opaque state in response to irradiation for an accumulated duration of time by infrared light having desired characteristics, thereby to prevent light from the optical scanning machine from  
30 penetrating the reactive compound and to render the data undetectable by the optical scanning machine.

More particularly, an optical disk is provided which is adapted for use in an optical readout system of a computer wherein the optical readout system includes a  
35 light source operative to produce an interrogating beam of

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light for reading data structures. Broadly, the optical disk according to the first collection of embodiments of the present invention includes an inner layer having an upper surface and a lower surface, with the lower surface thereof encoded with information stored as a plurality of data structures that are readable by the interrogating beam of light. The outer layer is disposed in a confronting relationship with the lower surface, and a film of a reactive compound is superimposed over at least some of these data structures. The reactive compound is selected to be of a type which is operative to change physical characteristics in response to a selected stimulus, thereby to affect readability of the data by the interrogating beam.

Preferably, the optical disk includes a layer of reflective material interposed between the lower surface and the reactive compound. This reactive compound may be supported on a lower surface of the disk's second layer and have a thickness of approximately 2-5 microns or, alternatively, it may be interposed between the lower surface and the disks outer layer. The lower surface is preferably contoured to include a sequence of pits and lands which define the plurality of data structures, with the reactive compound superimposed over at least some of these pits and lands.

The selected stimulus to which the reactive compound responds is an ambient environment selected to be either visible light, infrared light, light and oxygen, or simply air. Where the stimulus is light alone, the reactive compound may be a photoreactive material and preferably one selected from a spiropyran class of photochromic compounds. One such compound may be 6-nitro-1'3'3'-trimethylspiro-[2H-1benzothiopyran-2,2'-indoline] , or 6-nitro-1-S-BIPS for short. Such a photochromic compound is operative to change from an optically opaque or darkened condition in response

to an interrogating beam wavelength of approximately 780 nanometers (nm) and thereafter return to an optically transparent condition in response to a irradiation by a beam of light having a wavelength of approximately 337  
5 nanometers (nm).

Where the stimulus is a combination of light and oxygen, the reactive compound would therefore be photoreactive with oxygen and preferably operate to change its physical characteristics in response to an  
10 interrogating beam of light having a wavelength of approximately 650 nanometers (nm), which is encountered with digital versatile disk (DVD) readers.

Where the environmental stimulus is simply air (more precisely, oxygen), the reactive compound may be one which  
15 is operative after an accumulated duration of time to oxidize and alter an optical characteristic thereof. For example, such a reactive compound would change from an optically transparent condition to an optically opaque condition wherein it absorbs light having a wavelength  
20 within a desired range. This wavelength could be either 650 nanometers (nm), as discussed above, but may also be in the range of 780 to 820 nanometers (nm). The oxidizing reactive compound may be selected from a group of dyes consisting of methylene blue, brilliant cresyl blue, basic  
25 blue 3 and toluidine blue 0.

A methodology of limiting access to data stored on an optical medium such as an optical disk is provided by the first collection of embodiments. Broadly, this methodology comprises the steps of rotating an optical disk in a disk  
30 drive at a selected rotational speed, with the optical disk including a substrate layer encoded with information stored thereon as a plurality of readable data structures. A reactive compound is preferably superimposed over at least some of these data structures and this reactive compound  
35 operates in an ambient environment containing oxygen to

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change optical transmission in response to irradiation for an accumulated duration of time by light having a beam wavelength that is within a selected range. An interrogating beam of light having a beam wavelength that is within the selected range is directed toward the substrate layer and through the reactive compound for the accumulated duration of time.

The step of directing the interrogating beam may be accomplished by directing the beam at the substrate layer for a continuous interval of time that is sufficient to cause the change in optical transmission through the optical medium. Alternatively, the interrogating beam may be directed at the substrate layer for a plurality of discrete intervals of time sufficient to cause such change. Where this is the case, it is contemplated that the interrogating beam may be selectively advanced radially across an outermost surface of the optical disk until the beam interacts with the reactive compound for the plurality of discrete intervals of time. The interrogating beam's wavelength may be approximately 780 nanometers (nm) where a CD-Rom optical disk is utilized, or have a wavelength of approximately 650 nanometers (nm) which is the wavelength employed for digital versatile disks (DVD). Preferably, the interrogating beam also has an intensity of approximately 1 milliwatt (mW) of power, which is typically encountered in conventional optical readers.

In a second collection of embodiments of the present invention, a method and apparatus are provided for prohibiting unrestricted duplication of information on an optical medium such as an optical disk, wherein the user manually affects a physical change to the optical disk during an initial use of the optical disk. For example, the user may activate or perform a predetermined procedure for rendering one or more predetermined areas or locations of the optical disk unreadable or more error prone. This

in effect "marks" the optical disk both visually to the user and computationally to a program for accessing information on the optical disk (e.g., graphical data, video data, audio data, text data and/or a software installation program) as having been previously used for accessing the information on the optical disk. Thus, in a subsequent attempt to access the information on the optical disk (e.g., a subsequent attempt to view a multimedia presentation such as a movie, or a subsequent attempt at reinstallation of a software application on the optical disk), it is possible to detect that the information on the optical disk has been previously accessed due to a change in the information on the disk that is able to be read by an optical reader. For example, the optical reader may detect a greater number of read errors than when the optical disk was first accessed for information retrieval.

Alternatively, in other embodiments of the present invention, instead of purposefully creating unreadable portions of the optical disk, a converse method and apparatus may be employed wherein a predetermined portion of the optical disk is initially unreadable and subsequently becomes readable. That is, a mask or covering may be attached to the optical disk during manufacture so that a predetermined portion of information on the optical disk is initially unreadable by an optical reader, but upon initial use of the optical disk, the user physically removes or changes the mask, thereby allowing a sufficient amount of the previously unreadable portion underneath the mask to be read. Accordingly, optical disk accessing software can be performed that detects a state change in the optical disk due to the removing or changing of the mask.

It is a further aspect of at least some embodiments of the present invention that an encoded identifier is provided to a user upon first use of an optical medium of

the present invention. Such an encoded identifier is particularly useful for prohibiting unwanted duplication and/or use of commercial software since the identifier is derived from a unique physical change of the optical disk, and, for example, serial numbers of the installation computer. Thus, the encoded identifier, when supplied during a reinstallation attempt and decoded, allows the present invention to determine whether the user is attempting to install the software on a computer different from the original installation. Thus, upon detecting a state change indicating the software has been previously installed, the present invention may restrict various kinds of access to the information on the optical medium. In particular, if the optical disk provides software programs that may be installed on a user's computer, installations beyond the initial installation may be prohibited if the installation is not on the same computer as the initial installation.

Other collections of embodiments of the present invention are also provided hereinbelow. In particular, collections of embodiments are described relating to verification and/or authentication of financial transaction cards or financial transactions.

These and other objects of the present invention will become more readily appreciated and understood from a consideration of the following detailed description of the exemplary embodiments of the present invention when taken together with the accompanying drawings, in which:

#### BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a perspective view of an optical readout system utilizing an optical disk (shown in partial phantom) according to the present invention;

Fig. 2 is a side view in elevation, and in partial cross-section, showing the optical readout system's interrogating beam positioned beneath a first type of data

structure stored on an optical disk according to a first exemplary embodiment of the present invention;

Fig. 3A is an enlarged cross-sectional view of area "A" in Fig. 2;

5        Fig. 3B is an enlarged cross-sectional view of area "A" in Fig. 2 after an accumulated duration of time so that the reactive compound associated with the optical disk of the first exemplary embodiment of the present invention has undergone a change in its physical characteristics;

10       Fig. 4 is a side view in elevation, and in partial cross-section, showing the optical readout system's interrogating beam positioned beneath a second type of data structure stored on the optical disk according to the first exemplary embodiment of the present invention;

15       Fig. 5A is an enlarged cross-sectional view of area "A'" in Fig. 4;

20       Fig. 5B is an enlarged cross-sectional view of area "A'" in Fig. 4 after an accumulated duration of time so that the reactive compound associated with the optical disk of the first exemplary embodiment of the present invention has undergone a change in its physical characteristics;

25       Fig. 6A is an enlarged cross-sectional view of an area "B1" of an optical disk according to a second exemplary embodiment of the present invention, with the optical readout system's interrogating beam positioned beneath a first type of data structure stored thereon;

30       Fig. 6B is an enlarged cross-sectional view of the same area "B" after an accumulated duration of time so that the reactive compound associated with the optical disk according to the second exemplary embodiment of the present invention has undergone a change in its physical characteristics;

35       Figure 7A is an enlarged cross-sectional view of an area "B'" of an optical disk according to a second exemplary embodiment of the present invention, with the

optical readout system's interrogating beam positioned beneath a second type of data structure stored thereon;

Fig. 7B is an enlarged cross-sectional view of the same area "B'" after an accumulated duration of time so that the reactive compound associated with the optical disk according to the second exemplary embodiment of the present invention has undergone a change in its physical characteristics;

Fig. 8 is a perspective view, partially peeled away, of a package for containing an optical disk utilizing any one of a variety of reactive compounds according to the present invention; Figure 9 is a bottom plan view showing a variety of applications for the reactive compound associated with an optical disk according to the present invention;

Figs. 10A, 10B and 10C present a flowchart of the steps performed when the present invention is used to install computer software residing on an optical disk that conforms with the inventive aspects of the present invention, wherein the user is required to make a manual change to the optical disk during the first installation using the optical disk;

Figs. 11A and 11B illustrate a manual approach to irreversibly changing the physical characteristics of an optical disk manufactured according to the present invention. That is, the optical disk here includes an additional layer bonded to the optical disk wherein upon removal by the user, the information encoded on the optical adjacent to the additional layer is damaged;

Fig. 12 illustrates the removal of the additional layer (denoted a "ripcord") that is also shown in Figs. 11A and 11B;

Figs. 13A and 13B illustrate an alternative embodiment to the optical disk embodiment of Figs. 11A - 12B for purposefully damaging an optical disk manufactured



according to the present invention. In particular, in Figs. 13A and 13B, a chemical container or sack is bonded to an optical disk so that upon rupturing of the container (during, e.g., an initial optical disk use), the information on the optical disk is purposefully damaged, thereby allowing a subsequent installation process to detect the previous access to the information on the optical disk;

Figs. 14A and 14B illustrates cross-sections of the optical disk of Figs. 13A and 13B, wherein Fig. 14A shows the chemical container prior to rupturing and Fig. 14B shows the chemical container after rupturing;

Figs. 15A and 15B illustrate another alternative embodiment for purposefully damaging an optical disk wherein an external device is used that can etch or scar the optical disk and thereby reduce the readability of disk information in a particular area of the disk;

Figs. 16A and 16B illustrate yet another embodiment of the present invention for purposefully damaging an optical disk manufactured according to the present invention. In the embodiment of these figures, an external device is used for applying one or more chemicals to a particular or predetermined portion of the optical disk and thereby inducing additional read errors from an optical disk reader;

Figs. 17A and 17B illustrate an alternative embodiment of an optical disk manufactured according to the present invention, wherein an additional layer is provided on the optical disk during manufacture for hiding or masking a particular portion of the information on the optical disk;

Fig. 18 illustrates the removal of the additional layer (also denoted a "ripcord") from the optical disk of Figs. 17, wherein the optical disk information masked by the ripcord is now capable of being read by an optical reader;

Figs. 19A and 19B illustrate another embodiment of the present invention, wherein a container or sack having one or more chemicals is attached to an optical disk during manufacture so that this container initially masks or  
5     distorts information encoded into the optical disk; however, upon rupturing of the container, the masked information on the optical disk is now capable of being read by an optical reader;

Fig. 20 illustrates the embodiment of the present  
10     invention shown in Figs. 19A and 19B, wherein Fig. 20 shows the cross-section of the optical disk after the chemical container is ruptured; and

Figs. 21A and 21B illustrate the use of an external device having an enclosed chemical that can be used for  
15     removing or changing the optical characteristics of a patch or additional layer that masks information on the optical disk;

Fig. 22 is a flowchart of the steps performed in the present invention in verifying the identity of user  
20     requesting to perform an electronic financial transaction via, for example, the Internet.

#### DETAILED DESCRIPTION

The present invention is, in one sense directed to an  
25     optical disk for use in a computer's optical readout system, which optical disk is constructed to prohibit unrestricted access, by the readout system, to information stored on the disk. As such, the optical disk of the present invention is particularly adapted as an alternative  
30     approach for combating the growing piracy problems resulting from the illegal misappropriation of software products. As will be appreciated, the present invention is also directed to a methodology for limiting access to data stored on an optical medium. While both the optical disk  
35     of the present invention and the methodology for utilizing

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the same in a computer's optical readout system is described herein with reference to a conventional CD ROM disk, the ordinarily skilled artisan would readily appreciate that the teachings of the present invention may also be applied to other types of optical disks, such as audio CD's, WORM (Write Once Read Many) optical disks, and DVD (Digital Versatile Disks), to name only a few.

With this in mind, then, a typical optical readout system 10 of a computer incorporating an optical disk according to the first exemplary embodiment of the present invention is introduced in Figs.1 and 2. Optical readout system 10 broadly includes a disk drive 12 which is operative to rotate an optical disk 50 at a selected rotational speed, a light source 20 for producing an interrogating beam of light and a detector 40 which is operative to collect a returned component of the interrogating beam and to produce an output signal correlated to this returned component.

More specifically, and as is known in the art, disk drive 12 includes a motor 14 comprising a drive shaft 16 and a spindle 18 to which the CD-Rom optical disk 50 is mounted, and this motor 14 operates to constantly vary the rate at which the optical disk 50 is spun so that, regardless of where detector 40 is located in relation to the radius of optical disk 50, the portion of disk 50 located immediately above detector 40 is always moving at the same rate. Unlike conventional magnetic disks, which are divided radially into sectors and spin at a constant angular velocity, data on a CD-Rom disk is contained in a single track that spirals from the center of the disk to its circumference. This track is still divided into sectors, but each sector is the same physical size. Using a method known as constant linear velocity, the disk drive 12 constantly varies the rate at which (optical disk) 50 spins so that as detector 40 moves toward the center of the

optical disk 50 the disk increases its rotational speed. The effect of this is that the optical disk 50 can contain more sectors than a conventional magnetic disk and, consequently, more data.

5       Light source 20 generates an incident or interrogating beam of light via laser diode 22 and this beam 23 is initially collimated by collimator 26. The collimated beam is then directed toward a polarized beam splitter, or prism 28, after which it is sent through a quarter wave plate 30. 10 Alternatively, for optical readout systems wherein the laser diode 22 and collimator 26 are offset in position relative to beam splitter 28, a wedge mirror prism may be employed to direct the beam in an axial direction relative to optical disk 50. After collimated beam 24 encounters 15 quarter wave plate 30 it is thereafter directed through an objective lens 32 and an appropriate focusing coil to produce a concentrated and focused interrogating beam 25.

20       Focused interrogating beam 25 penetrates substrate 52 of optical disk 50 and typically strikes a metallic reflective layer 56 that is coated on the substrate 52. Metallic layer 56, itself, is encoded with information stored as a plurality of data structures 58 and is specifically contoured to include a sequence of lands 57 and pits 59 which define these data structures 58. This 25 may be accomplished with a conventional stamping process wherein metallic layer 56 is pressed into substrate 52 to create pits 59. Lands 57 are those areas which are not pressed and remain in their original position. Metallic layer 56 is approximately 1 micron thick and pits 59 are, 30 by design, only one quarter wavelength of the wavelength of interrogating beam 25. Lands 57 and pits 59 correspond to the 1's and 0's used to store data information. The interrogating beam 25 from laser diode 22 is focused at the surface level of lands 57, as shown. Whereas, light that 35 strikes a pit 59 is scattered, light that strikes a land 57

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is reflected as a returned beam 27 and directed back through polarized beam splitter 28. Beam splitter 28 deflects the returned beam 27 towards a tracking error detector 42, which controls tracking and focusing of the laser beam to sub-micron levels, and ultimately to light detecting photo diode 44. Light that strikes photo diode 44 generates a small electrical voltage at electrical leads 46, 48 and these voltages are matched against a timing circuit to generate the stream of 1's and 0's that the computer can understand. Accordingly, photo diode 44 converts the presence or absence of lands into an electrical signal.

The construction of a first exemplary embodiment of optical disk 50 may better be appreciated now with reference to Fig. 3(a) which is an exploded view of area "A" in Fig. 2. Optical disk 50 is constructed somewhat similarly to CD-Rom disks or audio compact disks now available. That is, as discussed above, optical disk 50 includes a substrate 52 and a metallic layer 56 upon which a protective coating 54 is placed. The metallic layer 56 is formed so that it is encoded with the information stored thereon as the plurality of data structures 58 that are readable by interrogating beam 25. Substrate layer 52, which may be formed out of polycarbonate, is disposed in a confronting relationship with metallic layer 56. As shown, metallic layer 56 is interposed between a lower surface 55 of protective coating 54 and substrate 52.

Unique to the present embodiments of the invention, though, is the inclusion of a film of reactive compound 60 that is superimposed over at least some of data structures 58. This reactive compound 60 is selected to be of a type which is operative to change physical characteristics in response to a selected stimulus, and thereby to affect readability of the information by interrogating beam 25.



reactive compound 60 changes its physical characteristics to an optically opaque condition whereby interrogating beam 25 is absorbed by the reactive compound 60 and is no longer able to penetrate the substrate 52 to detect the presence of land 57. Therefore, light detecting photo diode 44 does not receive a returned beam, as expected, and generates an improper electrical signal to the computer. As far as the optical readout system 10 is concerned, the interrogating beam 25 is positioned directly beneath a pit as opposed to a land, resulting in an incorrect data transferred to the computer.

Figs. 4 and 5A-5B illustrate the situation where interrogating beam 25 is positioned directly beneath a data structure 58 in the form of a land 57. It may be appreciated that, here, light source 20 has been advanced either radially or circumferentially across the outer surface 51 of substrate 52 to a different location as dictated by the computer's program. Looking at the exploded area A' in Fig. 5A, it is seen that interrogating beam 25 is initially able to penetrate both reactive compound 60 and substrate 52 and impinge upon metallic layer 56 which coats land 57. Because reflective material 56 in this region is not positioned at the level of the interrogating beam's focal point, interrogating beam 25 is scattered. Thus, either no returned beam is reflected or an insufficient amount of light is reflected back to photo diode 44, thereby resulting in the generation of a binary electrical signal by detector 40 which corresponds to the presence of the encountered pit 59. This is the expected result.

After an accumulated duration of time, the region 62 of reactive compound 60 which is exposed to interrogating beam 25 becomes darkened or opaque. Light in this region 62 is absorbed and not allowed to penetrate substrate 52 to detect the presence or absence of pit 59.

The result is, therefore, the same in that detector 40 generates a binary electrical signal, such as a zero, corresponding to the presence of a pit.

A second exemplary embodiment for the optical disk according to the first collection of embodiments may now be appreciated with reference to Figs. 6A - 6B and 7A - 7B. Here, the reactive compound 160 of optical disk 150 is shown to be interposed between the substrate 152 and metallic layer 156. While it is inherently more difficult to manufacture optical disk 150 than it would be to manufacture optical disk 50 which is referenced in the first exemplary embodiment of the present invention, the construction of optical disk 150 may be preferred from a performance standpoint because reactive compound 160 is located in a region where interrogating beam 125 would have a greater beam intensity than would beam 25 due to its relatively reduced focal width in this region. For all practical purposes, however, the results would nonetheless be the same.

For example, Fig. 6A again illustrates the situation where interrogating beam 125 is positioned beneath a land 157 such that the beam is reflected off of metallic layer 156 as a returned beam 127 which would be recognized by the detector and correctly converted into a corresponding binary electrical signal. In Fig. 6B, on the other hand, it is shown that after an accumulated duration of time, the region 162 of reactive compound 160 which has been exposed to a given environmental stimulus changes its physical characteristics from an optically transparent condition to an optically opaque or darkened condition. As such, interrogating beam 125 is absorbed in region 162 and no returned beam is detected, resulting in the generation of a binary electrical signal by the computer's optical readout system, despite the presence of pit 159. In Figs. 7A - 7B the situation is similar to that discussed above



with reference to Figs. 5A - 5B. Thus, when interrogating beam 125 is positioned directly beneath a pit 159, the computer's optical readout system would generate the proper binary electrical signal irrespective of the physical characteristic of reactive compound 160 in region 162.

A. Classes of Materials For the Reactive Compound

Various classes of materials have been found which exhibit appropriate physical characteristics for utilization in the optical disk according to the exemplary embodiments of the present invention. Each of these materials responds to either a specific environmental condition, or a combination of environmental conditions, to mask the data structures on an optical disk, thereby affecting their readability by the computer's optical readout system.

1. Photo Reactive Compounds

It has been found that photoreactive materials exhibit desired light absorption characteristics and that these materials may be formed as a coating on an optical disk to mask at least some of the disk's data structures from detection by an optical readout system. Photochromes, and specifically the spiropyran class of photochromes, have particular utility. Photochromism is the phenomenon whereby the absorption spectrum of a molecule changes reversibly or irreversibly when the sample is irradiated by light having certain wavelengths. For example, a colorless compound can change to a quasi-stable colored structure when it is irradiated with infrared light. While a specific photochromic or photosensitive material of the spiropyran class is discussed herein for use in the present invention, the ordinarily skilled artisan would appreciate that other photochromic materials such as aziridine derivatives, bipyridine derivatives, dihydroxyrene derivatives, fulgide derivatives, thioindigo derivatives, azobenzene derivatives, salicylideneaniline derivatives,

xanthane derivatives, oxazine derivatives may also prove useful.

One spiropyran class dye, having the chemical composition 6-nitro-1'3'3'-trimethylspiro-[2H-1-benzothiopyran-2,2'-indoline] , or 6-nitro-1-5-BIPS for short, is discussed in Tarkka, Richard U. Talbot, Marc E., et. al, "Holographic storage in a near-ir sensitive photochromic dye." Optic Comm. 109, 54-58 (1994), the teachings of which are incorporated herein by reference.

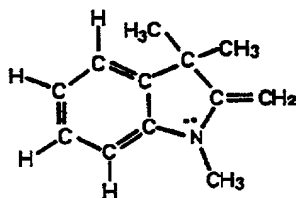
When exposed to infrared light having a wavelength of approximately 780 nanometers (nm), a wavelength which is predominantly utilized in current optical readout systems, this dye becomes colored. The dye may thereafter be returned to its optically transparent state upon exposure to an ultraviolet source at approximately 337 nanometers (nm). This ability to erase the color from the dye is not fatal in that it requires a relatively expensive and difficult to find light source. 6-nitro-1-S-BIPS is preferably applied as a coating to the substrate of an optical disk as illustrated in Figs. 3 - 5 above. With this spiropyran derivative, or other appropriate chromophores, it is recognized that the environmental stimulus is simply exposure to the light sources interrogating beam.

## 2. Compounds Which are Photoreactive in the Presence of Oxygen

Two materials which may also be used in conjunction with the optical disk according to the present invention are photoreactive in the presence of an ambient environment containing oxygen.

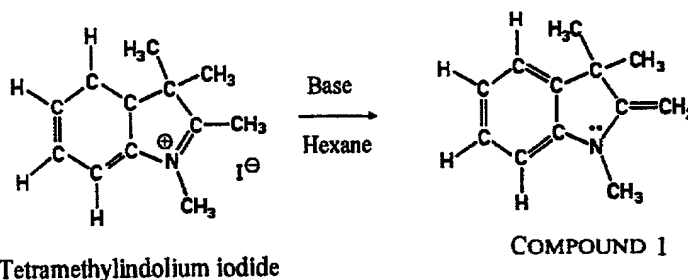
### a. Compound I

One such material is denoted as compound I below:



COMPOUND 1

Compound 1 is made by treating tetramethylindolium iodide with 10 Molar equivalents of 1N sodium hydroxide in water with good mixing. As compound I is formed, it is extracted into the hexane co-solvent according to the following reaction:



Alternatively, one molar equivalent of triethylamine in dichloromethane can be used and the product can be isolated by extraction with water, evaporation of a solvent and dissolution in hexane. The aqueous base method is preferred in that it yields in excess of 80% of the desired final product.

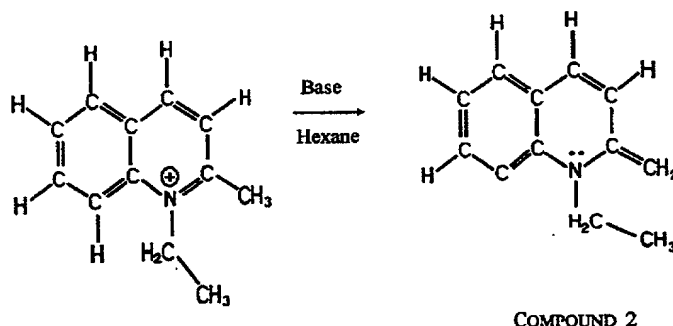
Compound I is photoreactive with oxygen and sensitive to ambient florescent light over several (> 18 hrs) exposure, is quickly (< -10 mins) photo oxidized upon exposure to an incandescent 150W lamp at a distance of 12 inches. Compound I also reacts upon exposure to light

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having a wavelength of approximately 650 nanometers (nm) and an intensity approximating that of a digital versatile disk (DVD) player light source. Accordingly, compound I is useful for application to an optical disk incorporated in developed DVD drives.

b. Compound II

Another material which is photoreactive in the presence of oxygen can be made from quinoline salts and related enamine derivatives. This photoreactive material is denoted as compound II below and may be prepared, similarly to compound I, according to the following reaction:



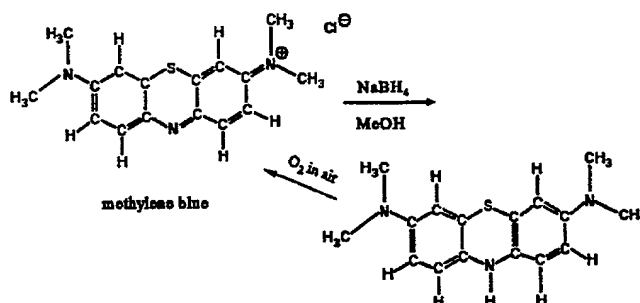
COMPOUND 2

With both compounds I and II above, it should be appreciated that the environmental stimulus which causes them to change in optical transmission is a combination of both light and oxygen. Moreover, these compounds are specifically adapted for use in a computer's optical readout system which utilizes a light source having a wavelength of 650 nanometers (nm). Because these compounds react to change their light absorption characteristics in the presence of an ambient environment containing oxygen, the required amount of time for such change varies depending upon the wavelength of the ambient light. It is, therefore, desirable that the optical disks coated with either compounds I or II, be packaged in an inert

environment and/or a standard hermetic packaging. To this end, Fig. 8 shows that such an optical disk 250 is preferably contained in a package 210 in the form of an aluminum bag coated with polyethylene. Contained within package 210 is an inert gaseous environment, such as argon, nitrogen, neon, helium, or other ambient gas.

c. Materials Which Are Oxygen Reactive

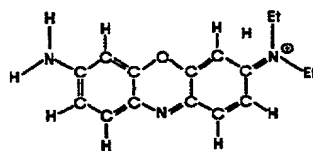
It has also been found that certain oxygen reactive materials may be used in an optical readout system having a light source at a selected wavelength. One class of such materials is based upon the reduced forms of the well known dye, methylene blue. The method of synthesis and the oxygen dependent reoxidation to form the colored form of the methylene blue dye is shown below:



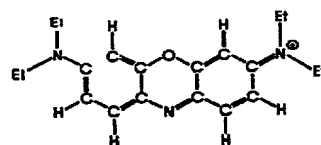
Various reducing agents can be used to reduce methylene blue and its many derivatives, with zinc and acetic acid being one possibility. The color of methylene blue when reduced is pale yellow and it quickly is re-oxidized to be dark blue by oxygen in air. The rate of this reaction is somewhat dependent on the medium, however. In polyurethane films, this rate has varied from about 10 minutes to 30 minutes depending on the concentration. When sodium borohydride residue is not quenched in these films, they gradually turn from clear to blue over several hours. The

blue form of the methylene blue dye absorbs strongly at 650 nanometers (nm), the centered wavelength for DVD laser light readers.

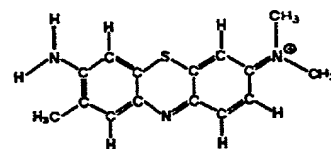
Other dyes which are reactive in the air (e.g., to oxygen) perform similarly to the methylene blue and have maximum absorbencies that can vary by several tens of nanometers. The structures of some of these dyes known to perform like methylene blue and their commercial names are shown below:



brilliant cresyl blue:



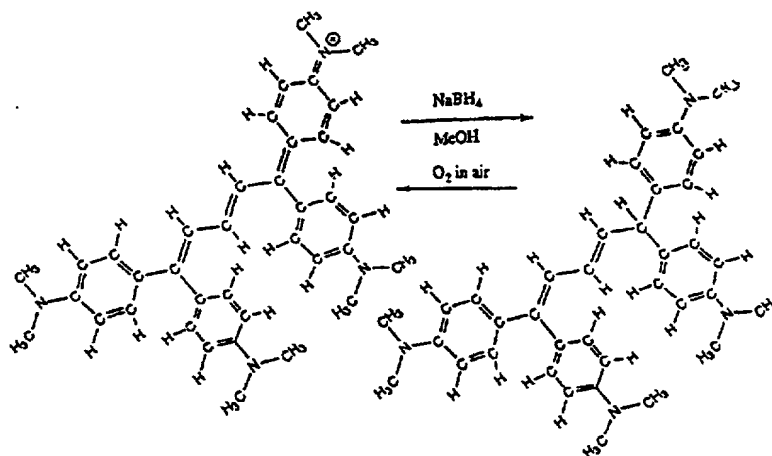
basic blue 3



toluidine blue 0

Finally, for optical readouts systems employing an interrogating beam having a wavelength of 780 nanometers (nm), a wavelength which is predominantly used in CD-Rom readers, one dye has been shown to reoxidize over approximately 48 hours and thereafter absorb light at this wavelength. The synthesis and oxidation of this dye, denoted as compound III, is shown below:

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oxygen, in order to prolong the useful life of the optical disk.

5 A primary thrust of the present invention is, of course, to deny access to a specially coated optical disk, and preferably a CD-Rom disk, beyond one or more authorized uses. To this end, one potential use for coating an optical disk with a reactive compound would be to allow for sample disks to be given away to customers in order for them to determine whether or not the product is worth  
10 purchasing. Once the product has been evaluated, the customer then might be required to return the product to the vendor and buy a commercial version of the sample optical disk. In one novel application of the present invention, such specially coated optical disks may have  
15 music encoded on them so that such disks are only playable for a particular period of time and/or for a particular number of times. Thus, optical disks that automatically expire are provided by the present invention. Moreover, note that movies and other multimedia presentations can be  
20 commercially provided in a similar fashion. Alternatively, a customer could purchase a coated optical disk and load it onto a computer's hard drive prior to the reactive compound changing its physical characteristics and rendering the optical disk unreadable.

25 Another potential application is the rental of optical disks which contain the reactive compound. Such an optical disk may be rented, much like videos cassette at a low cost and played until such time as the optical readout system of the disk player is no longer able to detect the presence or  
30 absence of the encoded information.

As shown in Fig. 9, the reactive compound may be applied to the optical disk in a variety of patterns. Fig. 9, of course, only illustrates a few such applications and others are certainly contemplated without departing from  
35 the concepts of the present invention. To illustrate,

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reactive compound 260 may be embossed as a film over an entire sector of optical disk 250, such as representative sectors 252 and 254. Alternatively, the reactive compound 260 may be applied to only a portion of a sector, such as region 256 in Fig. 9. Although, the entire surface of optical disk 250 could be coated with reactive compound 260, this is not a necessity, because the compound could merely be applied to that portion of the disk which contains critical information for the optical readout system to access in order for the software product to function properly. With specific reference to the spiropyran class of photochromes discussed above, it is also anticipated that a reactive compound of this type, which is adapted to reversibly change between a darkened colored state and a transparent state, could be initially be applied in its darkened state to the surface of the optical disk. A software application residing on an optical disk for the present invention may execute properly only in the event that the optical readout system continues to process information as if no data were contained in this region. Once the photochrome changes to the transparent condition upon sufficient exposure to light, the optical readout system would be able to detect the plurality of data structures, and the software application then discontinues its proper function.

With the foregoing in mind, the first collection of embodiments of the present invention is directed to an article of manufacturer adapted to be encoded with data and further adapted so that duplication of the data by an optical scanning machine may be restricted. To this end, the article of manufacturer comprises a substrate fabrication from a selected material and having a substrate surface which contains the data. A reactive compound is formed as a coating on at least a portion of the substrate surface and this reactive compound is operative to change

from an optically transparent state to an optically opaque state in response to a irradiation for an accumulated duration of time by light having selected characteristics, thereby to prevent the light from the optical scanning machine from penetrating the reactive compound and to render the data undetectable by the machine.

It should also be appreciated from the foregoing that another aspect of the present invention is a methodology of limiting access to data stored in an optical medium according to the first collection of embodiments. Broadly, this methodology comprises the steps of rotating an optical disk in a disk drive at a selected rotational speed, with the optical disk including a substrate and a metallic layer encoded with information stored thereon as a plurality of readable data structures and including a reactive compound superimposed over at least some of these data structures. The reactive compound is operative in an ambient environment containing oxygen to change optical transmission in response to irradiation for an accumulated duration of time by light having a beam wavelength that is within a selected range. The broad methodology would also include a step of directing an interrogating beam of light having a beam wavelength that is within the selected range toward the substrate and through the reactive compound for the accumulated duration of time.

The step of directing the interrogating beam of light could be accomplished by directing the beam toward the substrate for a continuous interval of time that is sufficient to cause the change in optical transmission. The methodology also contemplates that the interrogating beam can be directed at the substrate for a plurality of discrete intervals of time sufficient to cause the change in optical transmission. This might occur, for example, where the light source of the computer's optical readout system selectively advances the interrogating beam radially

across an outermost surface of the optical disk until the beam interacts with the reactive compound for the plurality of discrete intervals of time. It is preferred that the methodology be practiced with a beam wavelength approximately either 780 or 650 nanometers (nm) and a beam intensity of approximately 0.14 milliwatts (mW) 0.6 mW of power.

In Figs. 10A, 10B and 10C, a representative flowchart is provided of the steps performed in the method of the present invention according to the second collection of embodiments as described in the summary section hereinabove. That is, the flowchart of these figures illustrates the steps performed to prohibit unrestricted duplication and/or access of information on an optical medium or disk manufactured according to an embodiment of the present invention. In particular, the present method provides for purposefully inducing a physical change to the optical disk during its use; i.e., the physical change may be caused substantially automatically by, e.g., the activation of software on the optical disk, or alternatively may be caused as a purposeful effect of manual action by the user. More particularly, the flowchart of Figs. 10 illustrates the steps performed when installing software on a user's computer from an optical disk configured according to the present invention. Thus, in step 1000, the user inserts the optical disk into the optical disk drive (also denoted optical readout system or optical reader hereinabove). Subsequently, in step 1004, the user initiates or activates a start-up or installation program for processing information on the optical disk during an installation of the software on the optical disk. Note that this installation program may be read from the optical disk as a first portion of the information read. Alternatively, this installation program may be downloaded from the Internet. Upon activating the installation

15 Alternatively, if in step 1008, the user desires to fully install the software application from the optical disk, then step 1024 is performed, wherein one or more decryption procedures are installed into the user's computer from, e.g., the optical disk or the Internet.

20 Note that at least some of the information residing on the optical disk is encrypted so that it is not easily duplicated as a non-executable sequence of bits or characters, and subsequently reverse engineered to obtain a fully functioning executable version of the software on

25 the optical disk. Thus, it is to be understood that in the subsequent steps for installing the application software from the optical disk to the user's computer, that the encryption procedures installed in this step (1024) are activated one or more times for decrypting at least some

30 crucial information transferred between the optical disk and the user's computer.

Subsequently, in step 1028, a determination is made as to whether a predetermined area of the optical disk has an occurrence of a profile of an expected physical change to the optical disk. That is, the start-up program assumes

that the optical disk is in a particular predetermined physical configuration or state when obtained from the manufacturing process, and during this step, the start-up program determines if the physical characteristics of the optical disk conform to this assumed initial state or whether an occurrence of a particular profile of an expected physical change has occurred. In particular, note that the expected physical change, if detected, is assumed to be due to a previous installation of the software of the optical disk.

It is worth mentioning that such an expected physical change during such a software installation procedure may be due to any one of a number of user initiated techniques. For example, an additional layer or substance can be incorporated into the optical disk in a predetermined area so that upon purposeful removal by the user of the layer or substance (either mechanically or chemically), the optical information coinciding on the optical disk with this layer is changed in an expected arrangement so that in a subsequent installation attempt, this expected arrangement can be detected. In particular, examples of such techniques are discussed hereinbelow and illustrated in Figs. 11A through 14B. Alternatively, in another technique, an external device may be utilized by the user to intentionally change a predetermined portion of the optical disk as described hereinbelow with reference to Figs. 15A through 16B. In yet another technique, a predetermined portion of the optical disk can be initially provided with an additional coating or layer that distorts or hides a predetermined portion of the optical disk information so that upon first use of the optical disk for installing the software therein, this layer is either removed or changed in some fashion so that the information encoded underneath is capable of being read by the optical disk reader. In particular, this technique is described

and illustrated hereinbelow with reference to Figs. 17A through 21B. However, for each such technique it is an aspect of the present invention that in most embodiments the predetermined portion of the optical disk having an intentional change is limited to a minority of the storage capacity of the optical disk.

Moreover, in one important class of embodiments wherein the expected physical change is due to a change in the errors detected (e.g. either an increase or a decrease in errors), additional steps may be performed by software implementing the flowchart of Figs. 10 wherein these additional steps activate and deactivate the optical disk error correction module(s) of the user's computer system. Note that this becomes an important time saving aspect of the present invention in that considerable time can be consumed by the error correction module(s) in attempting to read purposefully induced unreadable errors. Thus, by deactivating the error correction module(s) just before a determination of whether an occurrence of an expected profile of errors is made (i.e., just before steps 1028 and 1052 of Figs. 10), and subsequently reactivating the error correction module(s) immediately thereafter, considerable time may be saved in, for example, (re)installing software from the optical disk, activating a presentation of a movie from the optical disk, etc.

Returning now to the steps of the flowchart of Figs. 10, assuming that in step 1028 the expected change from the original optical characteristics of the optical disk is not detected, then step 1032 is performed wherein the installation procedure may request user specific data such as the user's name and/or other user identifying information. Following this step, in step 1036, the installation procedure may install substantially all the software from the optical disk with the exception of one or more portions that are necessary for activating the

Assuming that the optical disk has been reinserted, in step 1052 the installation procedure determines whether an expected profile of a physical change to the optical disk has occurred in a predetermined area of the disk. In particular, various embodiments of the present invention determine the physical change in the optical disk by analyzing a change, for example, in the errors generated when attempting to read certain predetermined locations on the optical disk. For instance, the change may be detected as: (a) a total number of errors generated in a sampling of locations in an area of the optical disk (e.g., a detected number of errors greater than a minimum threshold, or less than a maximum threshold), (b) a density of errors generated in a sampling of locations in an area of the optical disk (e.g., a detected density of errors greater than a minimum threshold or less than a maximum threshold), (c) a relative number of errors generated in a sampling of locations in an area of the optical disk, (d) a pattern of errors generated in a sampling of locations in an area of the optical disk, (e) a statistical analysis of the errors in a sampling of locations generated in an area of the optical disk, (e.g., a regression analysis). Moreover,

instead of determining various measurements related to errors detected, the physical change in the optical disk may be detected by computing a measurement related to the non-error generating locations of an area of the optical disk. Thus, by replacing the word, "errors", with the word, "non-errors" in (a) through (e) above, additional examples for detecting a change to the optical disk are obtained. Further, note that the change may be detected stochastically wherein, for example, a probability or likelihood measurement is computed for determining whether a change has been detected. Note that the physical change may be removing, replacing or rearranging an entire wedge extending through all layers of the optical disk. For instance, a tab on an edge on an optical disk may be broken from the optical disk as part of an initial installation. Moreover, in some embodiments, such errors are not only detectable, but they are also not capable of being corrected by error correction circuitry since the errors are so prevalent. However, it is also within the scope of the present invention to detect such a change by other techniques than error detection. For example, a detachable optically readable layer may mask alternative optically readable information. Thus, by removing (and/or rearranging) the detachable optically readable layer and exposing the alternative data, a change to the optical disk can be detected.

Referring again to step 1052 of Fig. 10C, if an expected profile of the requested physical change to the optical disk has not occurred, then the installation procedure terminates (i.e., the "no" branch is taken). However, assuming that such a profile of an expected physical change is detected, step 1056 is performed wherein the installation process determines a collection of characteristics that uniquely identify the computer and the optical disk combination. For example, characteristics



relating to the user's computer may be various serial numbers associated with the central processing unit, and other peripheral processors or devices. Additionally, regarding the optical disk characteristics, the installation software samples the detected changes to the optical disk in the predetermined area and subsequently encodes the locations of the changes in this predetermined area by generating one or more codes related to the optical readability of the disk in the predetermined area. Thus, by combining the characteristics of the user's computer with the encoded characteristics of the physical change to the optical disk and possibly an encoding of the user data entered, a unique encoded identifier can be generated as, e.g., a character string as described in step 1060. Note that hereinafter the unique identifier will be denoted as a "configuration fingerprint." As an aside, note that it is important that the unique physical characteristics of the optical disk be encoded into the configuration fingerprint since otherwise there is the potential for a user to use a configuration fingerprint based solely on the characteristics of the user's computer to illegally install software from optical disks of the present invention on any number of computers.

In step 1064, the configuration fingerprint is written into persistent storage on the user's computer, and additionally, the configuration fingerprint is output to the user. Subsequently, in step 1068, the installation procedure instructs the user to remove the optical disk from the computer and manually write the configuration fingerprint on the optical disk. Additionally, as described in step 1072, the user is instructed to enter the configuration fingerprint as written on the optical disk as input into the user's computer. Note that the entering of the configuration fingerprint by the user and the subsequent checking to determine whether the computed

10            Assuming that eventually the configuration fingerprints match in step 1076, step 1080 is performed wherein the installation procedure completes installation of the software from the optical disk.

It is worth noting, however, that even though the software of the optical disk may not be able to be installed at a computer different from the initial 35 installation computer, it is an aspect of the present

35 installation computer, it is an aspect of the present

invention that the software may be executed directly from the optical disk in the case where the software cannot be installed due to, for example, a mismatch of configuration fingerprints as determined in step 1092 above. That is, it is an aspect of the present method that the user may be able to execute the software of the optical disk on any computer capable of reading the disk by executing the software directly from the disk.

In some embodiments of the present invention, the configuration fingerprints may not be required to exactly match in order for a complete reinstallation (step 1096 above) to be performed. In particular, it is an aspect of these embodiments of the present invention that as long as the configuration fingerprints are sufficiently similar, the installation process of step 1096 is performed. Thus, if the optical disk becomes scratched accidentally in the predetermined area where the expected change is to occur, and certain components of the user's computer were replaced, then the user may still be allowed to install the software on the optical disk due to a sufficient similarity between the computed configuration fingerprint and the input configuration fingerprint.

Referring now to Figs. 11A - 21B, a second collection of embodiments (denoted hereinafter as the "manually activated embodiments") of the present invention are illustrated. Accordingly, these embodiments, as with the previous embodiments described, prohibit unrestricted duplication of information on an optical disk manufactured according to the present invention. However, in the manually activated embodiments, the user manually effects a physical change to the optical disk during an initial use so that this change can be detected upon subsequent uses of the optical disk. Thus, as with the previous embodiments that automatically change optical states when irradiated by an optical scanning machine, there is protection against

copying, duplication, unauthorized installation or use of the data on the optical disk.

In Figs. 11A - 12, a first of the manually activated embodiments is illustrated. In the embodiment illustrated in these figures optical disk 1150 includes painted surface 1154 and protective lacquer layer 1158 as the uppermost surfaces. Additionally, as is typical for such disks, there is also a metalized or reflective layer 1162 and a transparent polycarbonate layer 1166. To these layers the present invention provides an extra or additional assembly 1170 for purposefully generating an expected profile of read errors on the optical disk 1150 (this additional assembly 1170 is hereinafter also denoted as a "rip cord") when this assembly is, for example, mechanically removed.

In the present embodiment, the rip cord 1170 includes (a) a substantially tear resistant patch 1174 (best shown in Fig. 11B) embedded within the optical disk 1170, and (b) a pull tab 1178 that is firmly attached to the patch 1174. Note that in the present figure there is a bonding layer 1182 bonding the patch to the reflective layer 1162. However, in general, the patch 1174 is attached or otherwise bonded to at least one of the sides of the metalized layer 1162 and/or lacquer layer 1158 of the optical disk 1150. For instance, the patch 1174 may be screwed, glued, welded, soldered, clipped or laminated onto the optical disk 1150. Moreover, the patch 1174 and/or the pull tab 1178 may be made of metal, plastic, wood or other suitable material that does not tear easily under tension. The patch 1174 may also be manufactured as part of another layer of the optical disk 1150; e.g., the reflective layer 1162.

Note that there can be various embodiments of a rip cord 1170 that can be mechanically manipulated to provide a physical change to an optical disk of the present

(1.1) a laminated layer with a pull tab  
(substantially as shown in Figs. 11A, 11B);

5 (1.2) an error generating push or twist button  
(not shown) having, for example, a particular  
arrangement of pins or other pointed objects that etch  
or scratch a surface of the optical disk 1150 when  
pressure and/or a twisting force is applied;

10 (1.3) a sticker, a strip of metal, an adhesive  
tape, a pin or other similar object that is effective  
for generating data access errors when detached from  
the disk.

25 In Figs. 13A - 14B, another embodiment of a ripcord is shown, this being a "chemical ripcord" 1370 provided on optical disk 1350, wherein this disk has layers corresponding to those of optical disk 1150; i.e., painted surface 1154, lacquer layer 1158, reflective layer 1162 and  
30 polycarbonate layer 1166. The chemical ripcord 1370 is incorporated into the optical disk 1350 as an ampule, globule, sac, macroscopic or microscopic chemical carrying liposome made of plastic, wood, metal or other suitable material that can be attached, bonded, glued or laid upon  
35 the optical disk as part of the manufacturing process. For

example, referring to Figs. 14A and 14B, when pressure is applied (e.g., as represented by force vector 1404), this chemical ripcord is ruptured (or moved, touched, rubbed, or otherwise disturbed) as shown in Fig. 14B. Subsequently, the chemical(s) within is released and/or activated for purposefully damaging the optical disk 1370, and in particular the reflective layer 1162, so that, for example, a greater number (or density or pattern) of optical disk read errors are generated in the area or location adjacent to the now disturbed chemical ripcord 1370. Thus, assuming an optical reader is enabled to detect and/or access the information corresponding to the data structures which are present at or near the location of the chemical ripcord 1370, the optical reader and/or application software associated with the present invention (e.g., as described in Fig. 10) can detect that the information near or adjacent to this location has changed state (e.g., from readable to unreadable) and accordingly, use this state change information for determining subsequent access and/or use of the information residing on the optical disk 1370 as, e.g., is described in Figs 10.

In Figs. 15A - 16B, two additional ripcord techniques for purposefully damaging an optical disk are illustrated, wherein a device external or unattached to the optical disk is used. Accordingly, the optical disk 1550 represented in the presently referenced figures may be a conventional optical disk with the possible exception that the painted surface 1154 may provide an indication as to where the optical disk is to be purposefully damaged. One such disk damaging technique is illustrated that uses an external device 1554 having, for example, a sharp point that can be used for mechanically and purposefully etching, scratching or otherwise damaging the optical disk 1550 as illustrated in Fig. 15B. Referring now to Figs. 16A and 16B, an alternative disk damaging technique is illustrated for a

disk such as 1550. That is, in this technique, a device 1654 that is external or separate from the optical disk 1550 is used for applying a particular chemical(s) 1658 that can purposefully damage at least a portion of the optical disk 1550 so that changes to its reflective characteristics are detected by an optical disk reader. In particular, the external device 1654 disclosed has an enclosed chemical compartment 1662 from which the chemical(s) 1658 are applied to the optical disk 1550, wherein the chemical(s) reacts with the optical disk 1550 for removing or damaging the reflective characteristics of the optical disk so that a greater number of read errors are generated in a predetermined area where the chemical(s) is applied.

Accordingly, in the embodiments of Figs. 15 and 16, an optical reader may be unable to detect or access a substantial amount of the information corresponding to the data structures at or near the use of the external device. Also, the optical reader (and/or other components or modules used in the accessing or processing of information from the optical disk 1550) may determine that the information on the optical disk has changed states (e.g. an indication of a prior use) according to the access errors detected in the predetermined area where the external device was applied (as in step 1052, Fig. 10B).

Additionally, note that an external device as 1554 or 1654 may also include a pin (or other sharp instrument) for both physically and chemically damaging the disk. Moreover, other embodiments for purposefully damaging an optical disk are also within the scope of the present invention. For example, the following may be used: a pad, a scratch inducing swatch, or, in a chemical application embodiment, a liposome carrying paste, a receptacle for holding two or more chemical compounds in separate chambers for purposefully damaging (more generally, changing) optical

characteristics of the disk when the two or more compounds are combined.

Thus, as described in Figs. 10, once the optical disk is physically changed, altered or otherwise damaged (e.g.,  
5 step 1044, Fig. 10B) by any of the above techniques, separately or in combination, the user's computer system may then determine the extent to which the information on the optical disk can be accessed or used in a user desired action. That is, the change and/or damage to the optical  
10 disk provides a recognizable state change to, for example, the access routines (e.g., installation programs) associated with the optical disk and/or any software application thereon so that a determination can be made as to whether the information on the optical disk has been  
15 previously accessed. In addition, such a change and/or damage to the optical disk also provides a user with a visible indication that the data on the optical disk has been accessed. More generally, the purposefully altering or changing of the optical disk provides a mechanism for determining a history of the use of the optical disk, both  
20 computationally and by visual inspection of the optical disk.

In Figs. 17A - 21B, converse embodiments to the purposefully damaging embodiments above are illustrated.  
25 That is, instead of the ripcord removing information from the optical disk (when the ripcord is manipulated and/or activated), the ripcord in the present embodiments allows additional or different optical disk information to become available (i.e., readable) when the ripcord is manipulated  
30 or activated. Thus, in these converse embodiments, instead of the read errors increasing according to an expected profile in a predetermined area of the optical disk, the read errors may decrease according to an expected profile. That is, the ripcord may initially hide or mask the  
35 information on the optical disk with a substantially

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unreadable covering. However, it is also within the scope of the present invention that such a ripcord covering may be readable and provide different information than that on the optical disk. For example, an optical disk may contain one or more movies for viewing and the ripcord itself may provide information necessary for allowing the movies to be viewed. Thus, once the ripcord is removed, thereby providing access to alternative information, the movie(s) may be viewed only once. Thus, in this embodiment, a detection of a state change is performed without necessarily detecting an expected profile related to generated access errors. It is also worth mentioning here that, as one skilled in the art will understand, similar capabilities may be provided with other duplication protection embodiments of the present invention. For example, by using an optical disk coating that changes from opaque to transparent due to, e.g., laser light from an optical disk reader, purposefully masked information on the optical disk can become readable and concomitantly causing a reduction in the number of errors detected and therefore providing a detectable state change in the optical disk.

Referring now specifically to Figs. 17A and 17B (where an optical disk 1750 is shown having similar layers labeled similarly to previous figures), a ripcord is attached or bonded to the exterior surface of the polycarbonate 1166 of an optical disk 1750; e.g., the ripcord 1770 may be laminated, screwed, glued, welded, soldered or clipped to the optical disk 1750. Moreover, the ripcord 1770 may include metal, plastic, wood, paper or other suitable material for hiding information encoded on the reflective layer 1182 of the optical disk 1750. Additionally, note that the ripcord 1770 may be manufactured as part of the optical disk, and can be in the form of a button, sticker, metal strip, adhesive tape, paper patch or other optical disk information mask (or optical distorter) capable of

being removed or rendered transparent to the laser light of the optical reader. Accordingly, when the ripcord 1770 of the present embodiment is removed (Fig. 18) from the optical disk 1750 or in some way moved or disturbed, additional (or alternative) information on the optical disk 1750 becomes readable. Thus, an optical disk reader is then able to detect and/or access this information at or near the previous ripcord location on the optical disk.

Note that additional converse embodiments may also be provided using a chemical approach. Referring to Figs. 19A and 19B (where an optical disk 1950 is shown having similar layers labelled similarly to previous figures), a ripcord 1950 herein includes a chemical carrying container (e.g., an ampule, globule, sac or liposome) attached, bonded, glued or combined with the optical disk 1950 during manufacture. Accordingly, as illustrated in Fig. 20, when this chemical container is removed, disturbed or ruptured, the enclosed chemical(s) is released and/or activated for modifying the reflective characteristics of the optical disk 1950 so that this information becomes readable. For example, the chemical sac of the ripcord 1970 may be glued to the exterior surface of the polycarbonate layer with an opaque or colored glue, wherein the chemical(s) within the chemical sac is a solvent for the glue thereby allowing the chemical sac and the glue to be removed when the sac is ruptured and the solvent released. Thus, an optical reader is subsequently able to detect and/or access the information corresponding to the data structures on the optical disk 1450 which are present at or near the previous location of the ripcord 1970 on the optical disk. Moreover, such a change to an optical disk allows the optical reader (and/or other optical disk accessing components or modules) as well as a person, via visual inspection, to determine that a state change has occurred to the optical disk 1950.

In Figs. 21A and 21B, an embodiment of the optical disk 1750 (Figs. 17) of the present invention is illustrated wherein an external device 2104 is used for applying a chemical(s) to the optical disk, thereby removing the mask or ripcord 1770 attached to the surface of the optical disk 1750 so that optical disk information hidden by the ripcord 1770 is able to be read. Note that the external device 2104 here can be in the form of, for example, a pin, pad, swatch or liposome carrying paste or liquid, wherein the ripcord is either rendered transparent or removed.

In a third collection of embodiments of the present invention, an authentication method and apparatus are provided for authenticating an optical disk. Embodiments of this third collection provide optical disks with purposefully-induced data access errors incorporated therein during manufacturing or at least prior to mass distribution. Moreover, also included in each individual optical disk is authentication information indicating the location of these purposefully induced errors. Thus, when the authentication information accurately identifies the locations of the purposefully induced errors, then the optical disk is assumed to be authentic rather than an illegitimate copy. Note that one particularly noteworthy embodiment in this third collection is provided by attaching "microdots", i.e., microscopic unreadable dots or patches, at various locations throughout the information encoded on an optical disk. Accordingly, if the microdots are sufficiently small so that they obscure or distort only a small area of the optical disk (e.g., less than approximately 300 microns) then error correction circuitry included within an optical disk access device may be able to correct such errors transparently to a user of the optical disk. Alternatively, for many applications, such as audio (e.g., musical) presentations, the optical disk

5 In a fourth collection of embodiments of the present invention, effectively non-reproducible transaction cards for financial transactions can be provided by the present invention. That is, an optical medium (such as a portion of an optical disk material) is provided on a transaction  
10 card along with a mechanism, such as a ripcord, for purposefully damaging the optical medium. Thus, prior to issuing such a transaction card to a user, the optical medium is purposefully damaged, and the financial institution stores an encoding of a mapping of the damaged  
15 and/or undamaged areas of the optical medium. Subsequently, the user is provided with the damaged transaction card. Thus, whenever a transaction is performed with the transaction card, the damaged optical medium thereon is optically sampled for determining if the  
20 samples are consistent with the encoded mapping stored by the financial institution. If so, then the transaction may be allowed. If not, then the transaction is canceled.

In a fifth collection of embodiments of the present invention, authentication of a user requesting a financial transaction is provided. In one such embodiment, a compound that is, for instance, sensitive to touch (e.g., oil reactive, heat sensitive and/or amino acid sensitive) may be layered or coated on an optical medium included on a transaction card (e.g., credit card). Thus, assuming the touch sensitive compound (e.g., a polymer) is sufficiently sensitive so that a user's fingerprint is reliably and accurately duplicated on the compound thereby causing a change in the optical characteristics of the optical medium, then once a fingerprint is provided on the touch sensitive compound, it can be optically sampled for sensing

Internet computer). Next, in step 2216, a process is activated on the user's Internet access device for optically sampling the predetermined touch sensitive area of the optical disk. Then, in step 2220, an encoding of the samples is transmitted to the particular Internet node responsible for determining the authenticity of the transaction. Thus, in step 2224, this particular Internet node compares the samples with a previously stored representation of the user's fingerprint for determining whether the samples are consistent with the fingerprint representation. Accordingly, if the samples are sufficiently consistent, then the transaction is completed as in step 2228. Alternatively, if this is not the case, then the transaction is voided as in step 2232.

In the sixth collection of embodiments of the present invention, information related to an item can be encoded on a time sensitive optical medium that changes optical characteristics over time so that the information transforms from readable to unreadable, or from unreadable to readable. In particular, certain compounds such as are disclosed above relating to the first collection of embodiments of the present invention may be utilized in the present collection of embodiments. For example, certain time sensitive items may require corresponding data for labeling, identifying and/or documenting of the items. For instance, such items may be cashier's checks or money orders that must be used in a financial transaction in a predetermined time period. That is, by using the present invention, bank routing numbers or other fields may be provided on a time sensitive polymer that becomes unreadable after a predetermined time has expired. Thus, prior to becoming unreadable, such identification data may be read by an automatic or computerized check clearing system, whereas after a predetermined time of, e.g., light exposure and/or oxygen exposure, the data becomes

unreadable. Additionally, event tickets and/or time sensitive medical supplies may also be similarly labeled with polymers of the present invention.

Accordingly, the present invention has been described at some degree of particularity directed to the exemplary embodiments of the present invention. It should be appreciated, though, that the present invention is defined by the following claims construed in light of the prior art so that modifications or changes may be made to the exemplary embodiments of the present invention without departing from the inventive concepts contained herein.

What is claimed is:

1. A method of limiting access to data stored on an optical medium, comprising the steps of:

5 (a) rotating an optical disk in a disk drive at a selected rotational speed, said optical disk including a substrate encoded with information stored thereon as a plurality of readable data structures and including a reactive compound contacted by a light for reading the data structures, said reactive compound operative in an ambient  
10 environment containing oxygen to change optical transmission in response to irradiation by said light for an accumulated duration of time, wherein said light has a beam wavelength within a selected range; and

(b) directing an interrogating beam of the light  
15 having a beam wavelength that is within said selected range toward said substrate layer and through said reactive compound for the accumulated duration of time.

2. The method of limiting access to data according to Claim 1 wherein said interrogating beam is directed at  
20 said substrate for a continuous interval of time that is sufficient to cause said change in optical transmission.

3. The method of limiting access to data according to Claim 1 wherein said interrogating beam is directed at  
25 said substrate for a plurality of discrete intervals of time sufficient to cause said change in optical transmission.

4. The method of limiting access to data according to Claim 1 wherein said beam wavelength is in a range of 780 to 820 nanometers (nm).

30 5. The method limiting access to data according to Claim 1 wherein said beam wavelength is approximately 650 nanometers (nm).

6. The method of limiting access to data according to Claim 1 wherein said step of directing said  
35 interrogating beam at said substrate layer is accomplished

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by selectively advancing said interrogating beam radially across an outermost surface of said optical disk until said interrogating beam interacts with said reactive compound for a plurality of discrete intervals of time sufficient to  
5 cause said change optical transmission.

7. A method of limiting access to data according to Claim 1 wherein said beam intensity is approximately .5 to 1.0 milliwatts (mW) of power.

8. A method of limiting access to data according to  
10 Claim 1 wherein said beam wavelength is approximately 780 nanometers (nm).

9. An optical disk adapted for use in an optical readout system of a computer that includes a light source operative to produce an interrogating beam of light for  
15 reading data structures, comprising: (a) reflective layer encoded with information stored thereon as a plurality of data structures that are readable by an interrogating beam of light;

(b) a substrate disposed in a confronting  
20 relationship with said reflective layer;

(c) a film of a reactive compound superimposed over at least some of said data structures, said reactive compound selected to be of a type which is operative to change physical characteristics in response to a selected  
25 stimulus, thereby to affect readability of the data by said interrogating beam of light.

10. An optical disk according to Claim 9 wherein said reactive compound is interposed between said reflective layer and said substrate.

30 11. An optical disk according to Claim 9 wherein said reflective layer is contoured to include a sequence of pits and lands which define said plurality of data structures, said reactive compound superimposed over at least some of said pits and lands.

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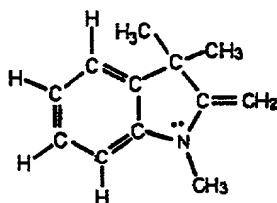
5           13. An optical disk according to Claim 9 wherein said stimulus is selected from a group consisting of visible light, infrared light, an ambient environment containing light and air.

15. An optical disk according to Claim 9 wherein said reactive compound comprises selected from a spiropyran class of photochromic compounds.

17. An optical disk according to Claim 9 wherein said reactive compound is operative to change to an optically darkened state in response to an interrogating beam wavelength of approximately 780 nanometers (nm) and thereafter return to an optically clear state in response to irradiation by a beam of light having a wavelength of approximately 337 nanometers (nm).

25           18. An optical disk according to Claim 9 wherein said stimulus is an ambient environment containing light and oxygen and wherein said reactive compound has the chemical formula:

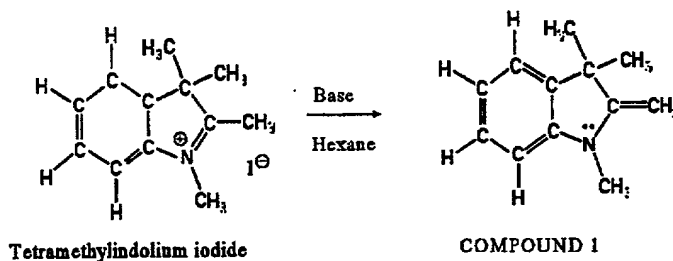
5



COMPOUND 1

19. An optical disk according to Claim 9 wherein said stimulus is an ambient environment containing light and air and wherein said reactive compound has the chemical formula:

15



20. An optical disk according to Claim 9 wherein said stimulus is air and wherein said reactive compound is operative for an accumulated duration of time to oxidize and alter an optical characteristic of the compound.

21. An optical disk according to Claim 9 wherein said reactive compound is operative to change from an optically transparent to an optically opaque condition wherein said reactive compounds absorbs light having a wavelength within a selected range.

22. An optical disk according to Claim 21 wherein said wavelength is approximately 780 nanometers (nm).

23. An optical disk according to Claim 21 wherein said wavelength is approximately 650 nanometers (nm).

24. An optical disk according to Claim 9 wherein said reactive compound is a chemically reduced form of a dye.

25. An optical disk according to Claim 9 wherein said reactive compound is selected from a group of dyes  
5 consisting of methylene blue, brilliant cresyl blue, basic blue 3 and toluidine blue 0.

26. In an optical disk for use in an optical readout system of a computer wherein said optical disk includes an inner substrate layer having a substrate surface encoded  
10 with information stored thereon as a plurality of data structures and an outer layer and wherein said optical readout system includes a disk drive operative to rotate the optical disk at a selected rotational speed, a light source operative to produce an interrogating beam of light  
15 at a selected beam wavelength and at a selected beam intensity and to direct said interrogating beam of light at the data structures, and a detector operative to collect a returned component of said interrogating beam and to produce an output signal in response thereto, an  
20 improvement comprising a film of reactive compound superimposed over at least some of said data structures, said reactive compound operative to change its physical characteristics in response to a selected environmental stimulus thereby to affect readability of the data by the  
25 interrogating beam of light.

27. The improvement of Claim 26 wherein said reactive compound is responsive to irradiation by the interrogating beam for an accumulated duration of time to change physical characteristics thereby to mask said data structures and to  
30 render said data structures undetectable by the optical readout system.

28. An article of manufacture adapted to be encoded with data and further adapted so that duplication of the data by an optical scanning machine may be inhibited,  
35 comprising:

(a) a substrate fabricated from a selected material and having a substrate surface which contains the data; and

(b) a reactive compound coating at least a portion of said substrate surface, said reactive compound operative to  
5 change from an optically transparent state to an optically opaque state in response to irradiation for an accumulated duration of time by infrared light having desired characteristics thereby to prevent light from the optical scanning machine from penetrating said reactive compound  
10 and to render the data undetectable by the optical scanning machine.

29. A method of limiting the use of information stored with an optical medium, comprising:

providing, to an optical reader, the optical medium  
15 having information for performing a desired action;

determining whether an expected profile of a purposefully induced change in the access of the information is detected;

performing the desired action using the information  
20 when said expected profile is detected; and

prohibiting said step of performing when said expected profile is not detected.

30. A method as claimed in Claim 29, wherein said optical medium is one of a compact disk and a digital  
25 versatile disk.

31. A method as claimed in Claim 29, wherein said step of determining includes detecting said purposefully induced change as one of: a distinctive pattern of errors, and a distinctive pattern of an absence of errors.

30 32. A method as claimed in Claim 31, wherein said step of detecting includes detecting one of the distinctive patterns by determining a related to one of the errors and the absence of errors.

33. A method as claimed in Claim 29, wherein said  
35 step of determining includes:

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sampling locations on the optical medium for detecting data access errors, wherein location data related to the detection of the data access errors is obtained;

comparing the expected profile with the location data  
5 for detecting said change in the access of the information.

34. A method as claimed in Claim 33, wherein said step of comparing includes evaluating a function dependent on one of: a number of errors detected, a relative number of errors detected, a pattern of errors, a density of errors detected and a location of errors detected.

35. A method as claimed in Claim 34, wherein a result of said function indicates that said expected profile is detected when there is at least one of: a minimum threshold number of errors detected, and a minimum threshold density in the number of errors detected.

36. A method as claimed in Claim 34, wherein a result of said function indicates that said expected profile is detected when there is at least one of: a maximum threshold number of errors detected, and a maximum threshold density in the number of errors is detected.

37. A method as claimed in Claim 33, wherein said step of sampling includes detecting data access errors not capable of being corrected by error correction modules receiving data via the optical reader.

25           38. A method as claimed in Claim 29, further including a step of damaging the optical medium by one of: a chemical reaction and a mechanical activity;

wherein said step of damaging is for obtaining said expected profile.

30           39. A method as claimed in Claim 38, wherein said  
step of damaging by a mechanical activity includes changing  
a reflective characteristic of the optical medium by one  
of: tearing and etching a layer of the optical medium.

40. A method as claimed in Claim 39, further  
35 including a step of encoding one of a damaged and undamaged

41. A method as claimed in Claim 29, wherein said  
5 step of performing includes correcting data access errors  
detected as part of said expected profile;

42. A method as claimed in Claim 41, wherein at least  
10 some of said access errors are induced by microdots.

44. A method as claimed in Claim 29, further  
15 including a step of creating access errors as an instance  
of said expected profile prior to performing said step of  
providing.

46. A method as claimed in Claim 38, wherein said step of damaging the optical medium includes changing a reflective characteristic of the optical medium by one of: exposing the optical medium to a reactive chemical, rupturing a chemical container attached to the optical medium, and exposing a predetermined part of the optical medium having a light sensitivity to an effective amount of light for changing the reflective characteristics of the optical medium.

47. A method as claimed in Claim 38, wherein said step of damaging includes removing an item attached to the optical medium.

49. A method as claimed in Claim 48, wherein said  
5 step of reducing includes performing one of: a chemical  
reaction and a mechanical activity for changing a  
reflective characteristic of the optical medium.

51. A method as claimed in Claim 49, wherein said step of performing includes changing a reflective characteristic of the optical medium by one of: purposefully exposing the optical medium to a chemical rupturing a chemical container of the optical medium, and exposing a predetermined part of the optical medium having a light sensitivity to an effective amount of light for reducing the access errors.

53. A method as claimed in Claim 52, wherein said  
step of determining includes reading identifying data on  
25 said card for identifying a previously stored  
representation of said expected profile.

30 55. A method as claimed in Claim 29, wherein said  
step of determining includes attempting to access a portion  
of the information residing within a predetermined part of  
the optical medium where the expected profile resides,  
wherein the predetermined part includes a minority of a  
35 total storage capacity of the optical medium.

56. A method as claimed in Claim 29, further including a step of deactivating an error correction module.

57. A method as claimed in Claim 56, wherein said  
5 step of deactivating is performed prior to each performance of said step of determining.

58. A method as claimed in Claim 57, further including a step of reactivating the error correction module after said step of determining.

10 59. A method as claimed in Claim 29 further including steps of:

encoding said purposefully induced change; and

outputting said encoded change to a user of the optical medium waiting to perform the desired action.

15 60. A method as claimed in Claim 59, wherein said step of encoding includes encrypting said purposefully induced change together with identification data related to at least one of: an identity of the user, and an identity of at least one component of a device used for processing  
20 the information on the optical medium.

61. A method as claimed in Claim 60, wherein said step of encrypting includes determining an identifying code for one of a central processing unit and a peripheral processing unit as said at least one component.

25 62. A method as claimed in Claim 29, wherein said step of providing includes purposefully inducing a change in access errors at each of one or more locations of the optical medium for instantiating said expected profile.

63. A method as claimed in Claim 62, wherein said  
30 step of purposefully inducing includes:

removing the optical medium from the optical reader;

altering an optical characteristic of the optical medium; and

providing, again, said optical medium to the optical  
35 reader.



65. A method as claimed in Claim 62, wherein said  
5 step of purposefully inducing includes one of rendering  
unreadable an initially readable portion of the optical  
medium and rendering readable an initially unreadable  
portion of said optical medium.

67. A method as claimed in Claim 66, further including a step of comparing a representation of said provided image with a previously stored representation of a body part image for determining a consistency between said provided image representation and said previously stored image representation.

69. A method as claimed in Claim 66, wherein said touch sensitive portion includes a compound reactive to one  
25 of heat, pressure, and a bodily produced substance.

30           71. A method as claimed in Claim 70, wherein said  
inputted code was previously provided to a user desiring to  
perform the desired action.

72. A method as claimed in Claim 70, wherein said  
inputted code was output during a previous performance of  
35 said step of determining.

73. A method of limiting the use of information stored on an optical medium, comprising:

providing, to an optical reader, an optical medium having information for performing a desired action;

5 detecting an expected profile of a change in access errors for the information on the optical medium;

comparing an encoding of the change with a user input;

performing the desired action using the information when said encoding provides a favorable comparison with the

10 user input; and

prohibiting a performing of the desired action when said encoding provides an unfavorable comparison with the user input.

74. A method as claimed in Claim 73, further  
15 including a step of encrypting together a representation of said change and identification data related to at least one of: an identity of the user, and an identity of a device for accessing the information on the optical medium;

wherein a result of said step of encrypting yields  
20 said encoding.

75. A method as claimed in Claim 74, wherein said step of detecting includes determining said change in the access errors by mapping locations of the access errors in at least one predetermined portion of the optical medium.

25 76. A method as claimed in Claim 75, wherein said predetermined portion extends to only a minority of the total data storage capacity of the optical medium.

77. A method as claimed in Claim 73, wherein said step of determining includes using a representation of  
30 locations of the access errors in an encryption process for obtaining said encoding.

78. A method as claimed in Claim 73, wherein data of said user input was obtained by the user from a previous attempt to access the information on the optical medium.

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79. An apparatus for limiting the use of information stored with an optical medium, comprising:

an optical medium having stored information, wherein said information is used in performing a desired action;

5 means for producing a change in the access errors encountered when accessing data locations for information on the optical medium, wherein the change corresponds with an expected profile;

10 means for detecting whether an instance of the expected profile has occurred;

means for determining when to perform the desired action using an output from said means for determining whether said instance has occurred.

80. An apparatus as claimed in Claim 79, further including means for performing the desired action when the instance of the expected profile is detected.

81. An apparatus as claimed in Claim 79, wherein said means for performing includes one of: means for loading software onto a computer, means for presenting a presentation, and means for conducting a financial transaction.

82. An apparatus as claimed in Claim 79, further including:

25 means for prohibiting an activation of the desired action when an instance of the expected profile is not detected.

83. An apparatus as claimed in Claim 79, further including:

30 means for performing the desired action until an instance of the expected profile is detected.

84. An apparatus as claimed in Claim 83, wherein said means for performing the desired action includes means for reading identification data from said optical medium, wherein said optical medium is provided on a financial

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85. An apparatus as claimed in Claim 84, wherein identification data includes bank routing data.

87. An apparatus as claimed in Claim 86, wherein said optically reflective material is included in one of a compact disk, digital versatile disk, and a financial transaction card.

89. An apparatus as claimed in Claim 79, wherein said means for detecting includes means for sampling data in one or more locations of the optical medium.

91. An apparatus as claimed in Claim 79, wherein said means for producing includes one of: a means for increasing access errors, and a means for decreasing access errors.

30           93. An apparatus as claimed in Claim 91, wherein said means for decreasing data access errors includes one of: a data mask attached to the optical medium, and a chemical sac attached to the optical medium.

94. An apparatus as claimed in Claim 79, wherein said  
35 means for producing includes an instrument detached from

said optical medium, wherein said instrument changes an external surface of said optical medium when applied to the optical medium.

95. An apparatus as claimed in Claim 94, wherein said  
5 instrument includes one of: means for scoring, and means for removing a layer of said optical medium.

96. An apparatus as claimed in Claim 79, further including an encoding means for encoding a representation of the change in the access errors, wherein said means for  
10 encoding includes means for outputting to a user encrypted data including an encryption of a combination of: (a) the change in the access errors, and (b) at least one of: an identification of the user and an identification a device for accessing the information on the optical medium.

97. An apparatus as claimed in Claim 96, wherein said  
15 means for outputting instructs a user to copy said encrypted data.

98. An apparatus as claimed in Claim 79, wherein a user desiring access to the information activates said  
20 means for producing prior to gaining access to the information.

99. An apparatus as claimed in Claim 79, further including storage for storing a representation of the change in the access errors, wherein said representation is  
25 referenced in said storage using an identification of a user having the optical medium.

100. An apparatus as claimed in Claim 99, wherein said representation is used in a verification process of a financial transaction.

101. A method of limiting access to stored data on an  
30 optical medium, comprising:

inserting the optical medium into an optical medium access device for accessing information in at least one of a predetermined first storage portion and a predetermined  
35 second storage portion of the optical medium;

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activating a desired computer application, wherein to perform said application, information in said predetermined second storage portion must be used;

purposefully inducing a change in the first storage  
5 portion, wherein said change is irreversible;

obtaining a response indicative of whether the purposefully induced change exists; and

determining whether to use the information in said predetermined second storage by accessing said response  
10 indicating the existence of said change.

102. A method as claimed in Claim 101, wherein said step of purposefully inducing includes damaging an optical characteristic of the first storage portion.

103. A method as claimed in Claim 101, wherein said  
15 step of purposefully inducing includes one of: removing a  
layer from the first portion, causing a layer of the first  
portion to become opaque, marring a layer of the first  
portion, and chemically distorting an optical  
characteristic of the first portion.

20            104. A storage medium having limited access,  
             comprising:

a first storage portion of the storage medium, wherein said first storage portion includes one or more data storage locations, wherein the locations are related to a data accessibility profile;

a means for changing the accessibility of data at the locations, where the change is purposeful and substantially irreversible;

wherein when said means for changing is applied to the  
30 locations, said profile is obtained.

105. A storage medium as claimed in Claim 104, wherein said storage medium is an optical disk.

106. A storage medium as claimed in Claim 104, wherein  
said means for changing includes a detachable portion of  
35 the storage medium, wherein the data accessibility profile

is detected during an access of the locations when said detachable portion is detached from the storage medium.

107. A storage medium as claimed in Claim 104, wherein  
said means for changing generates one of a decrease and an  
5 increase in the number of errors during access to the data  
at the locations.

108. A storage medium as claimed in Claim 104, wherein data in a second storage portion of the storage medium is accessible in response to an indication that said data accessibility profile exists.

109. A method of limiting access to stored data on a storage medium, comprising:

inserting the storage medium into a storage access  
device for accessing information in at least one of a  
15 predetermined first storage portion and a predetermined  
second storage portion of the storage medium;

activating a desired computer application, wherein to perform said application, information in said predetermined second storage portion must be used;

20           purposefully inducing a change in the first storage  
portion;

selecting a sampling of a plurality of the storage medium locations, wherein the locations of the sampling are selected so that there is a predetermined density of samples within the first storage portion;

detecting said change by accessing the locations of the sampling;

obtaining a response indicative of whether the purposefully induced change exists; and

30       determining whether to use the information in said  
predetermined second storage by accessing said response  
indicating the existence of said change.

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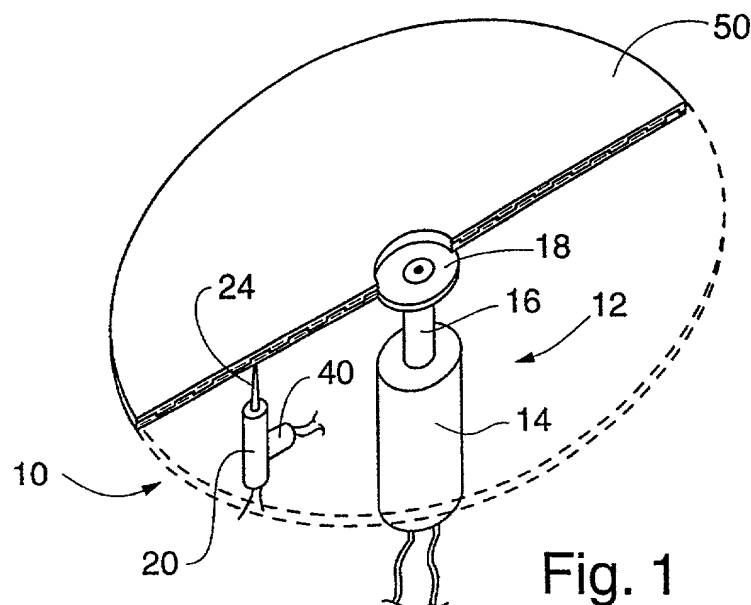


Fig. 1

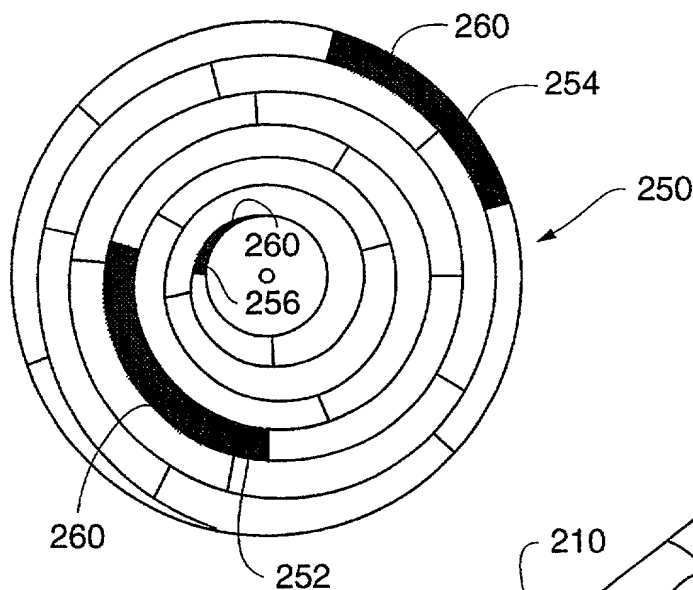


Fig. 9

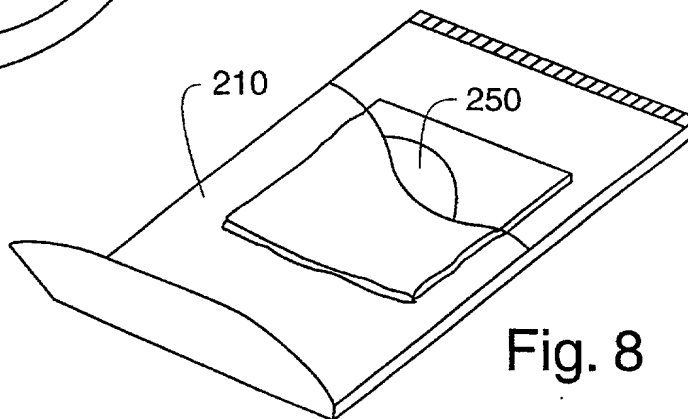


Fig. 8

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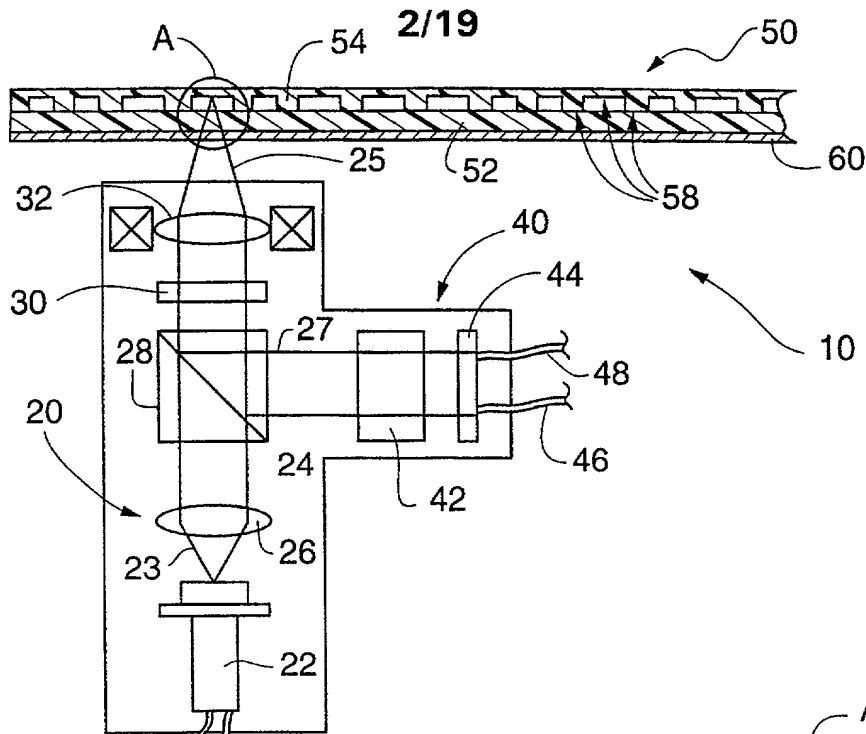


Fig. 2

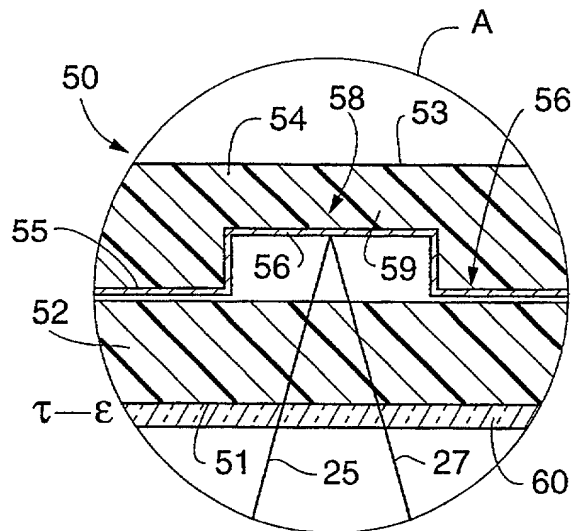


Fig. 3A

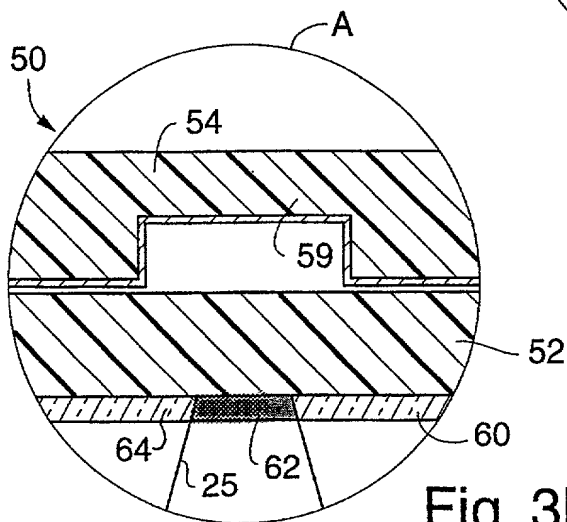
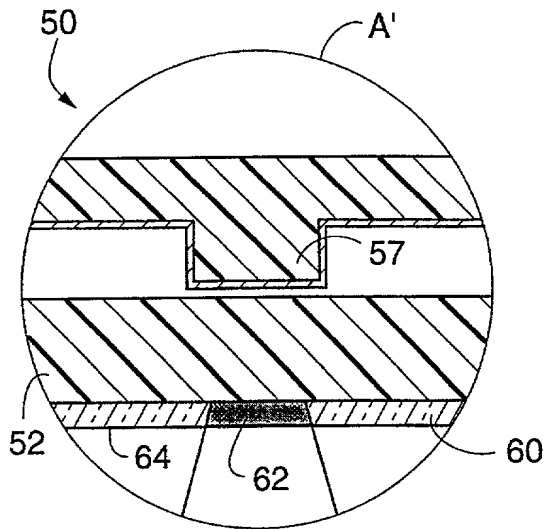
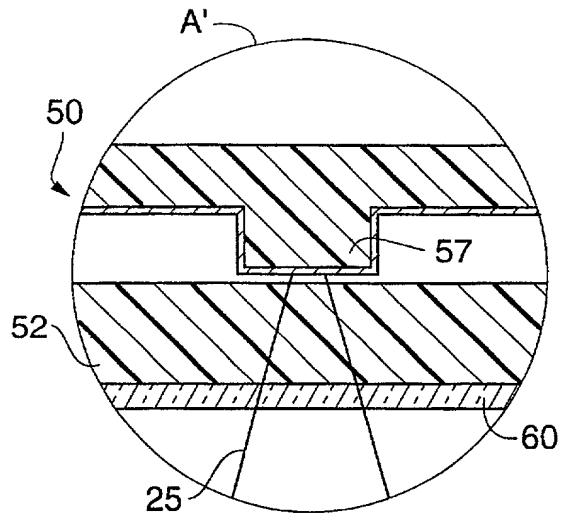
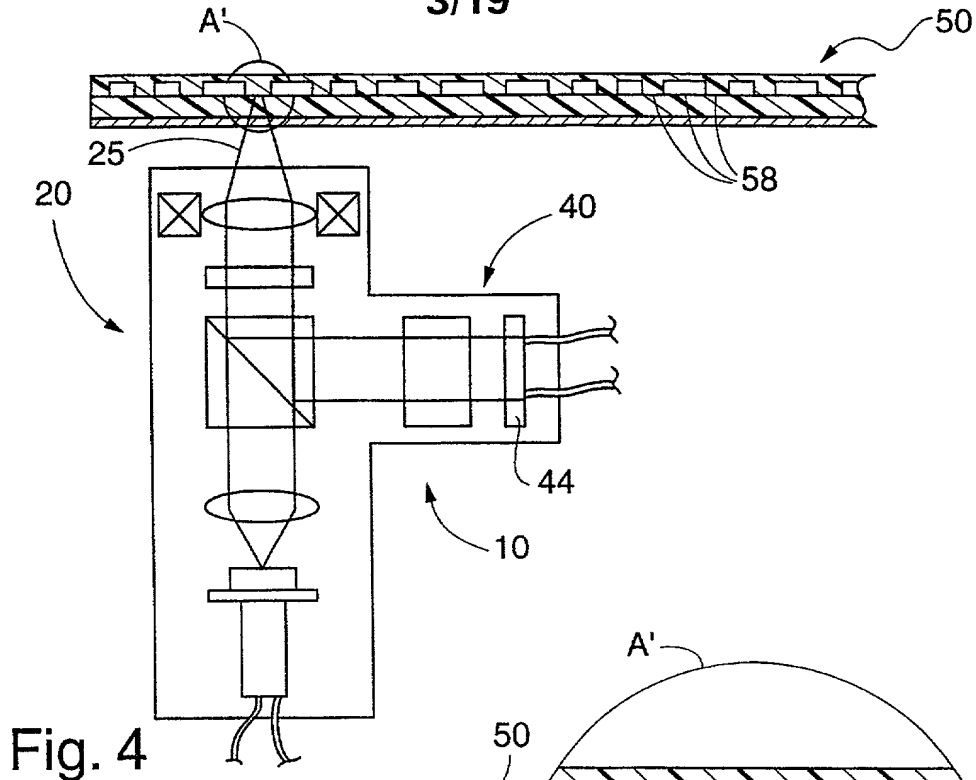


Fig. 3B

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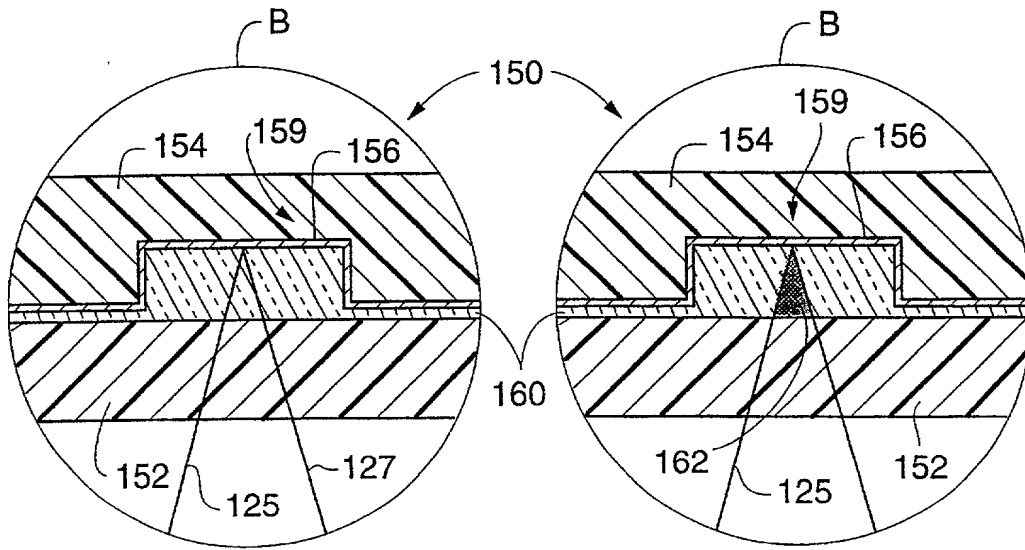


Fig. 6A

Fig. 6B

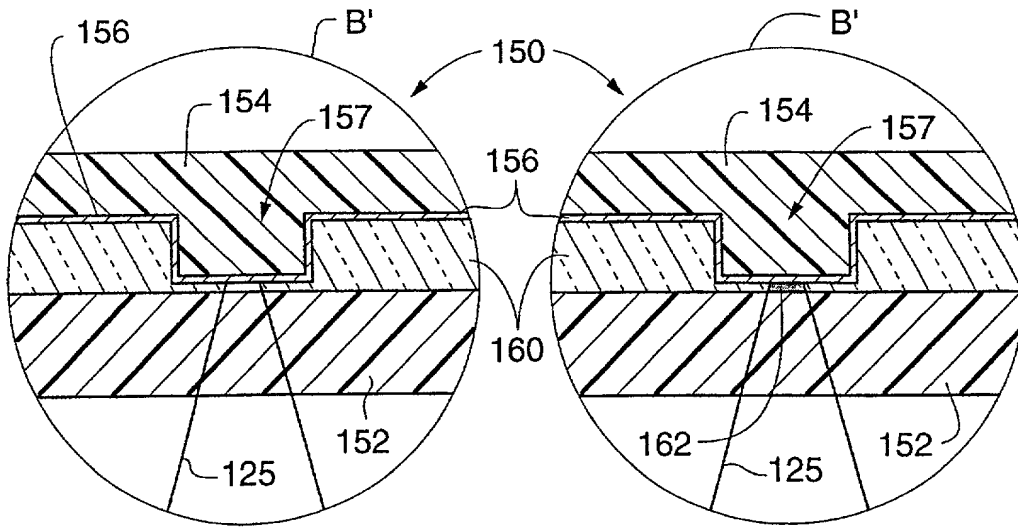


Fig. 7A

Fig. 7B

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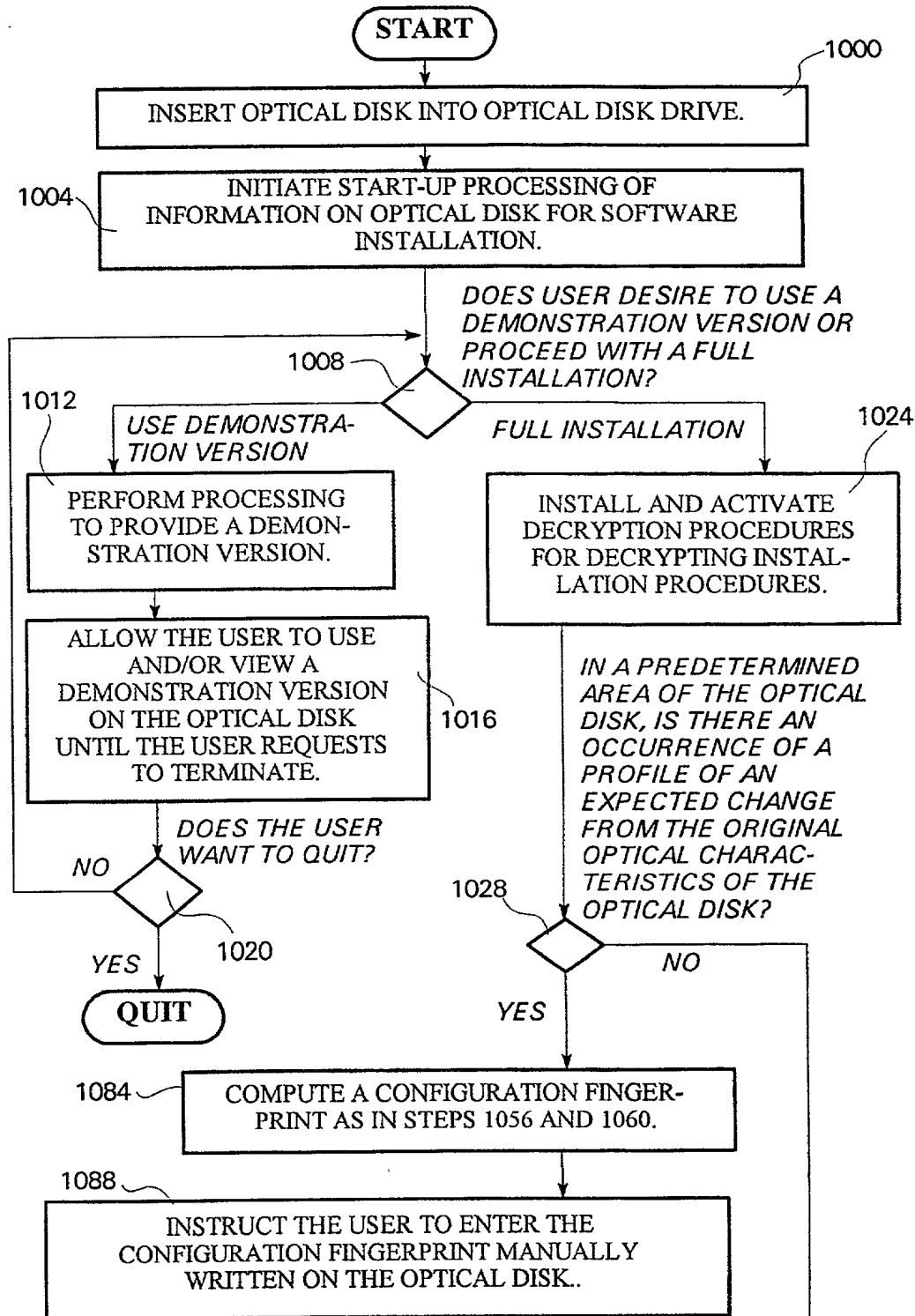


FIG. 10A

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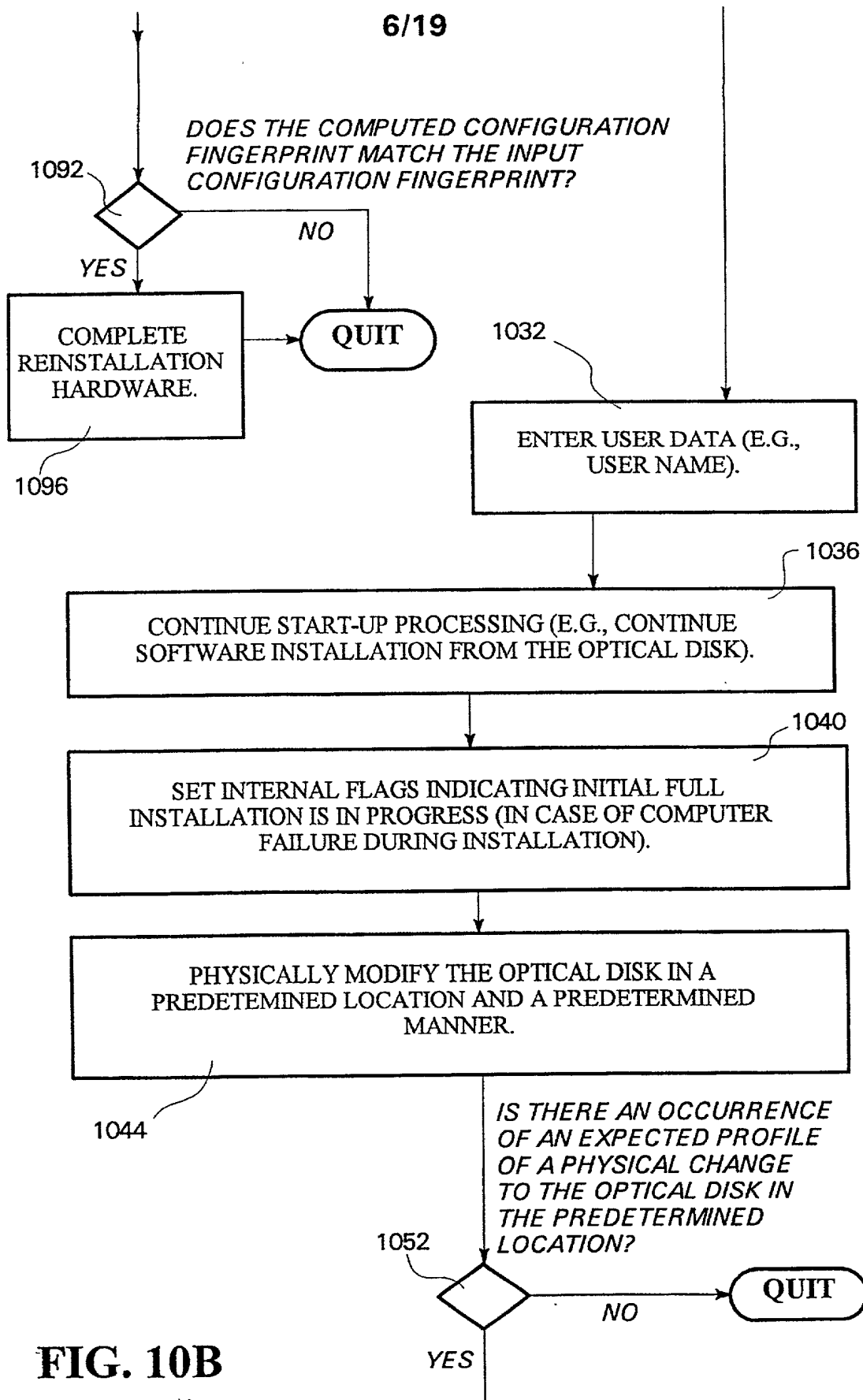


FIG. 10B

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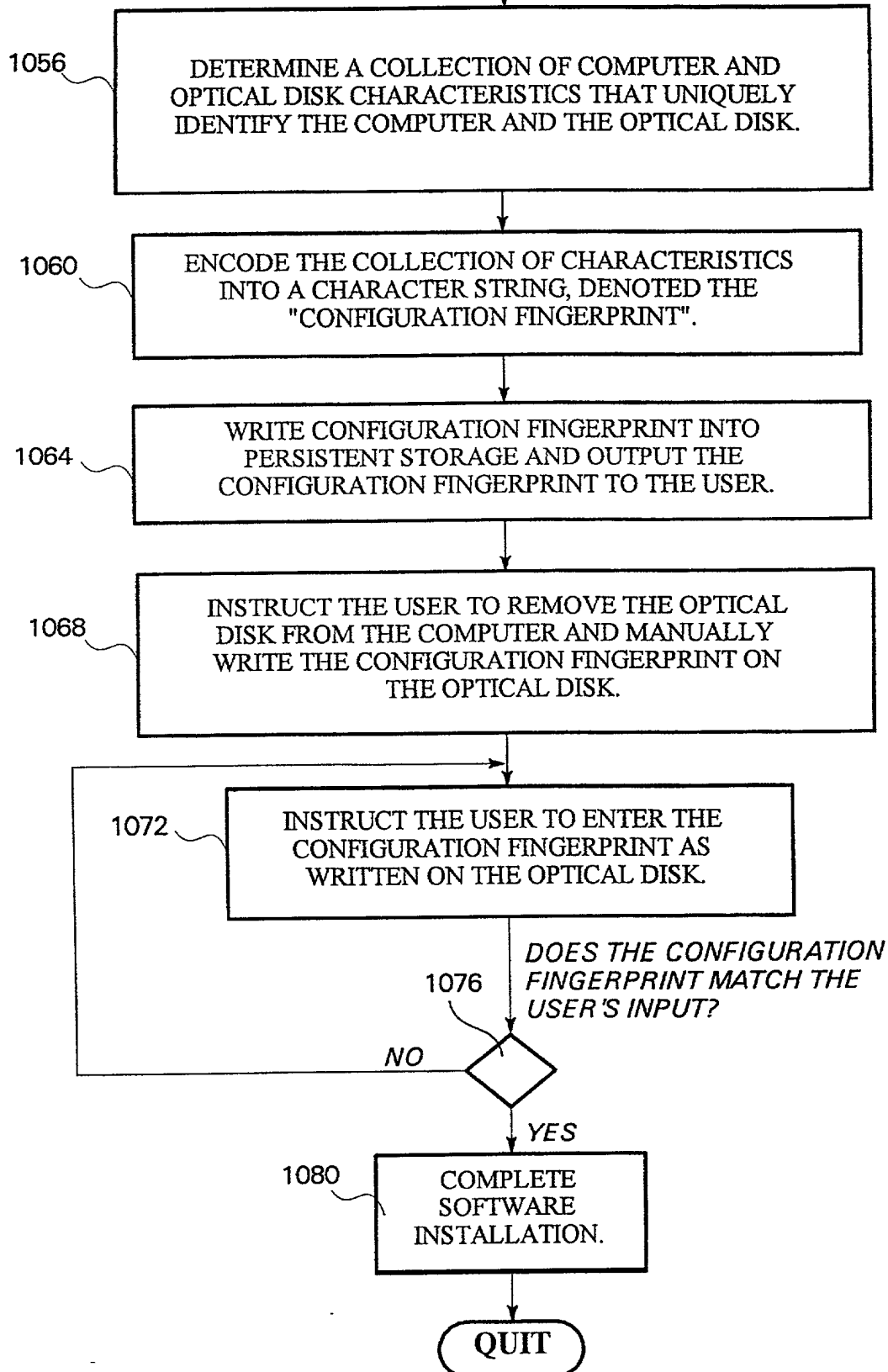


FIG. 10C

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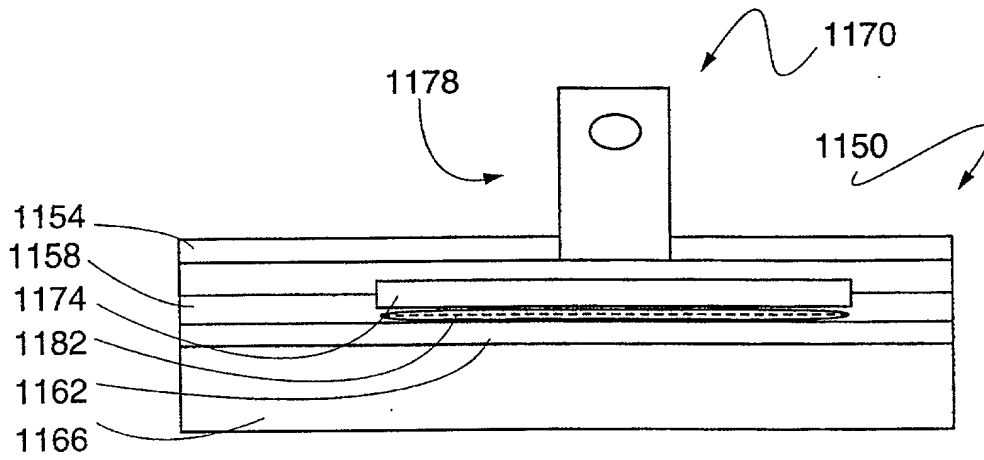


Fig. 11A

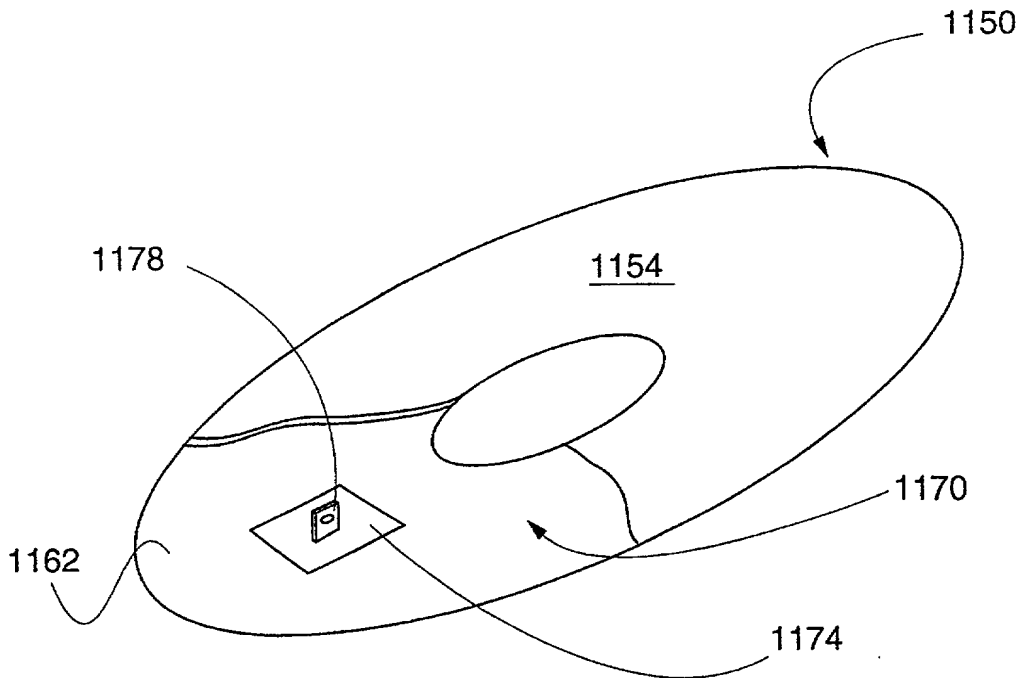
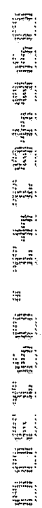


Fig. 11B

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Variable	Mean	SD
Age	40.1	10.2
Gender	Male	75.3
Marital status	Married	68.5
Education	High school	15.2
Occupation	Manager	22.1
Income	\$30,000	18.7
Health status	Good	72.4
Exercise frequency	Weekly	35.6
Dietary habits	Healthy	45.8
Stress level	Low	28.9
Sleep quality	Good	65.3
Family size	2-3	55.1
Work hours	40-50	62.7
Commuting time	30-45	48.2
Living space	Urban	70.5
Neighborhood safety	Safe	78.9
Access to parks	Yes	60.4
Public transportation	Good	52.3
Crime rate	Low	42.1
Weather	Mild	38.7
Cost of living	Reasonable	58.6
Quality of life	High	75.2
Community involvement	Active	40.8
Healthcare access	Good	68.9
Job satisfaction	High	55.4
Work-life balance	Good	62.1
Financial stability	Stable	70.3
Overall happiness	High	82.5



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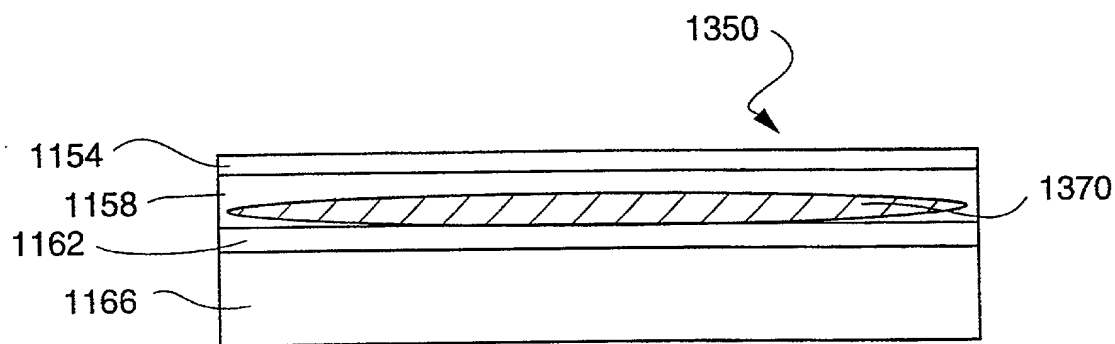


Fig. 13A

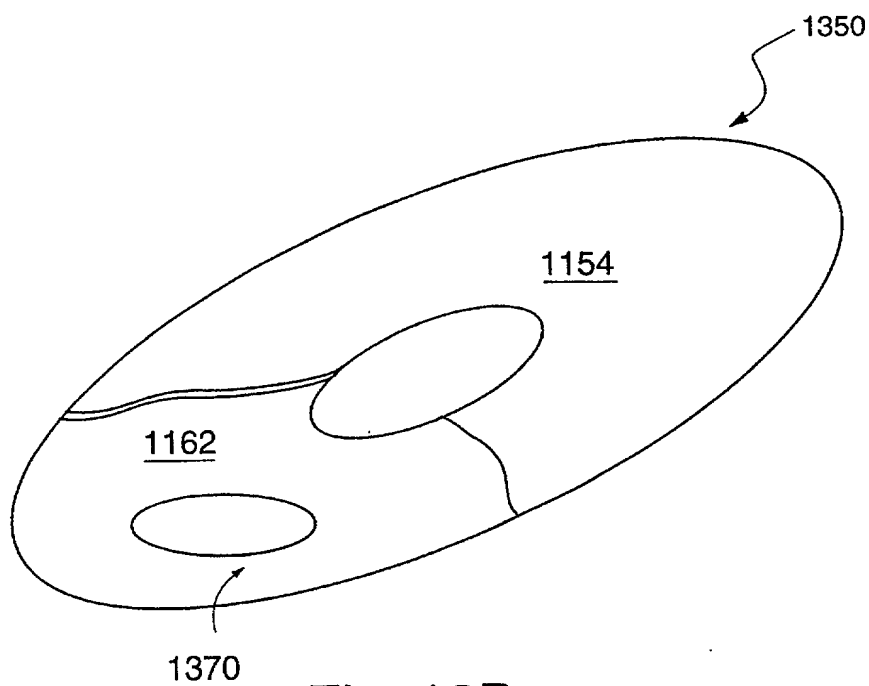


Fig. 13B

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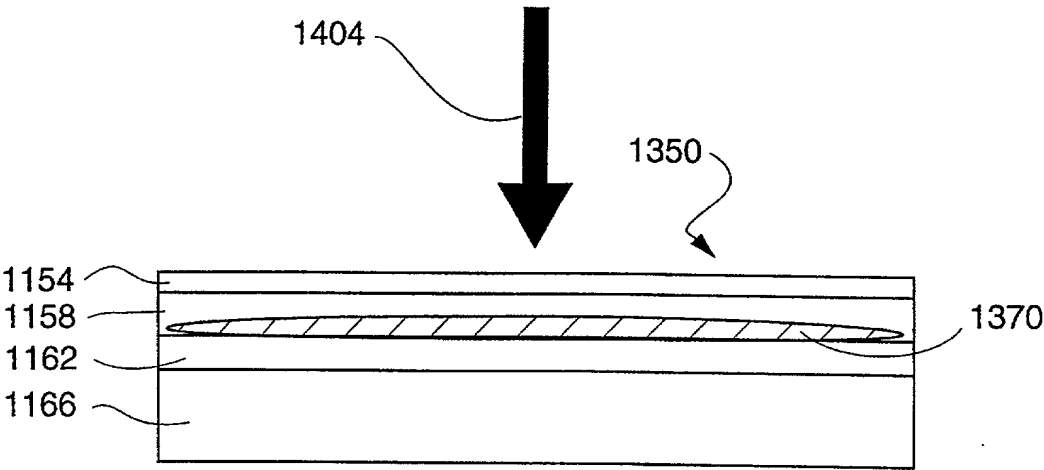


Fig. 14A

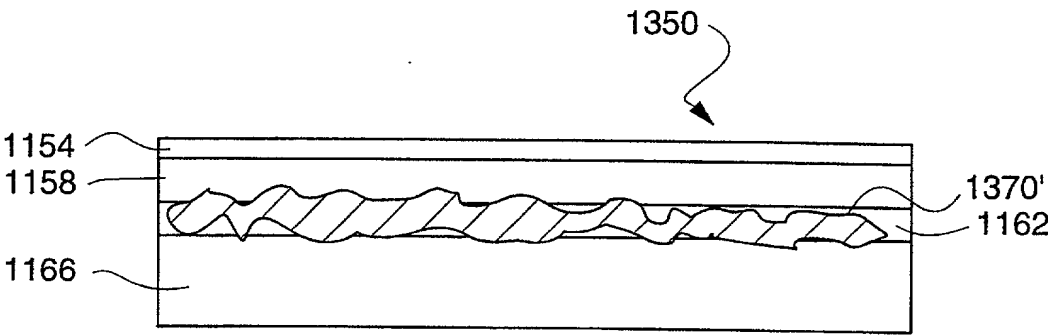
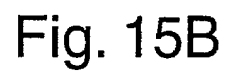
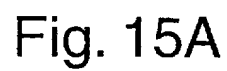


Fig. 14B



1990-1991		1991-1992		1992-1993		1993-1994		1994-1995		1995-1996		1996-1997		1997-1998		1998-1999		1999-2000		2000-2001		2001-2002		2002-2003		2003-2004		2004-2005		2005-2006		2006-2007		2007-2008		2008-2009		2009-2010		2010-2011		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2028-2029		2029-2030		2030-2031		2031-2032		2032-2033		2033-2034		2034-2035		2035-2036		2036-2037		2037-2038		2038-2039		2039-2040		2040-2041		2041-2042		2042-2043		2043-2044		2044-2045		2045-2046		2046-2047		2047-2048		2048-2049		2049-2050		2050-2051		2051-2052		2052-2053		2053-2054		2054-2055		2055-2056		2056-2057		2057-2058		2058-2059		2059-2060		2060-2061		2061-2062		2062-2063		2063-2064		2064-2065		2065-2066		2066-2067		2067-2068		2068-2069		2069-2070		2070-2071		2071-2072		2072-2073		2073-2074		2074-2075		2075-2076		2076-2077		2077-2078		2078-2079		2079-2080		2080-2081		2081-2082		2082-2083		2083-2084		2084-2085		2085-2086		2086-2087		2087-2088		2088-2089		2089-2090		2090-2091		2091-2092		2092-2093		2093-2094		2094-2095		2095-2096		2096-2097		2097-2098		2098-2099		2099-2100		2100-2101		2101-2102		2102-2103		2103-2104		2104-2105		2105-2106		2106-2107		2107-2108		2108-2109		2109-2110		2110-2111		2111-2112		2112-2113		2113-2114		2114-2115		2115-2116		2116-2117		2117-2118		2118-2119		2119-2120		2120-2121		2121-2122		2122-2123		2123-2124		2124-2125		2125-2126		2126-2127		2127-2128		2128-2129		2129-2130		2130-2131		2131-2132		2132-2133		2133-2134		2134-2135		2135-2136		2136-2137		2137-2138		2138-2139		2139-2140		2140-2141		2141-2142		2142-2143		2143-2144		2144-2145		2145-2146		2146-2147		2147-2148		2148-2149		2149-2150		2150-2151		2151-2152		2152-2153		2153-2154		2154-2155		2155-2156		2156-2157		2157-2158		2158-2159		2159-2160		2160-2161		2161-2162		2162-2163		2163-2164		2164-2165		2165-2166		2166-2167		2167-2168		2168-2169		2169-2170		2170-2171		2171-2172		2172-2173		2173-2174		2174-2175		2175-2176		2176-2177		2177-2178		2178-2179		2179-2180		2180-2181		2181-2182		2182-2183		2183-2184		2184-2185		2185-2186		2186-2187		2187-2188		2188-2189		2189-2190		2190-2191		2191-2192		2192-2193		2193-2194		2194-2195		2195-2196		2196-2197		2197-2198		2198-2199		2199-2200		2200-2201		2201-2202		2202-2203		2203-2204		2204-2205		2205-2206		2206-2207		2207-2208		2208-2209		2209-2210		2210-2211		2211-2212		2212-2213		2213-2214		2214-2215		2215-2216		2216-2217	
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Fig. 16A

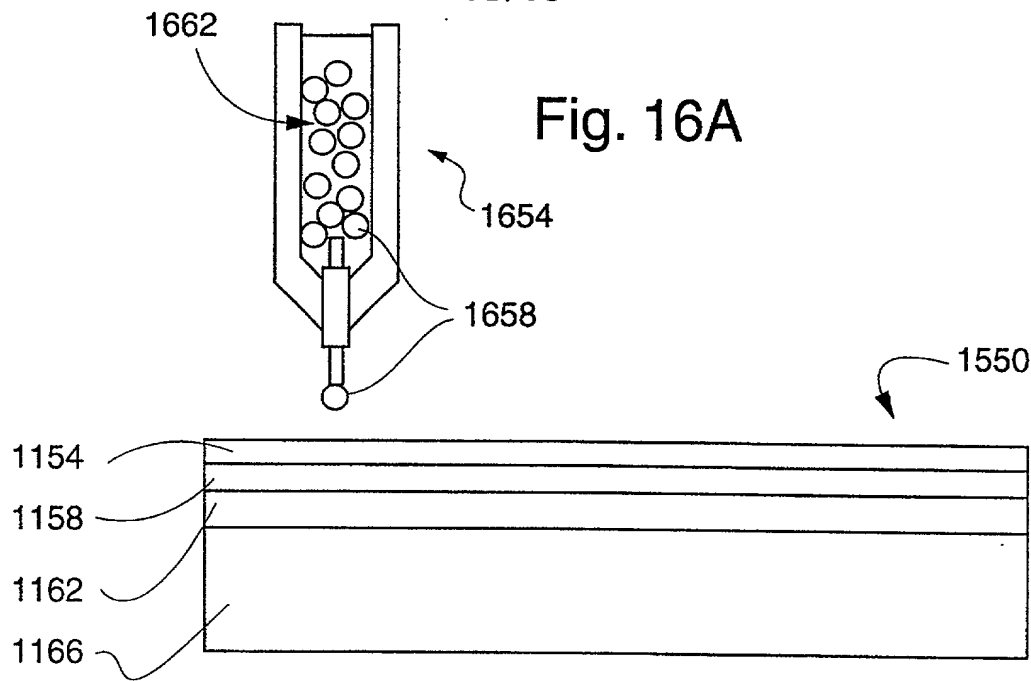
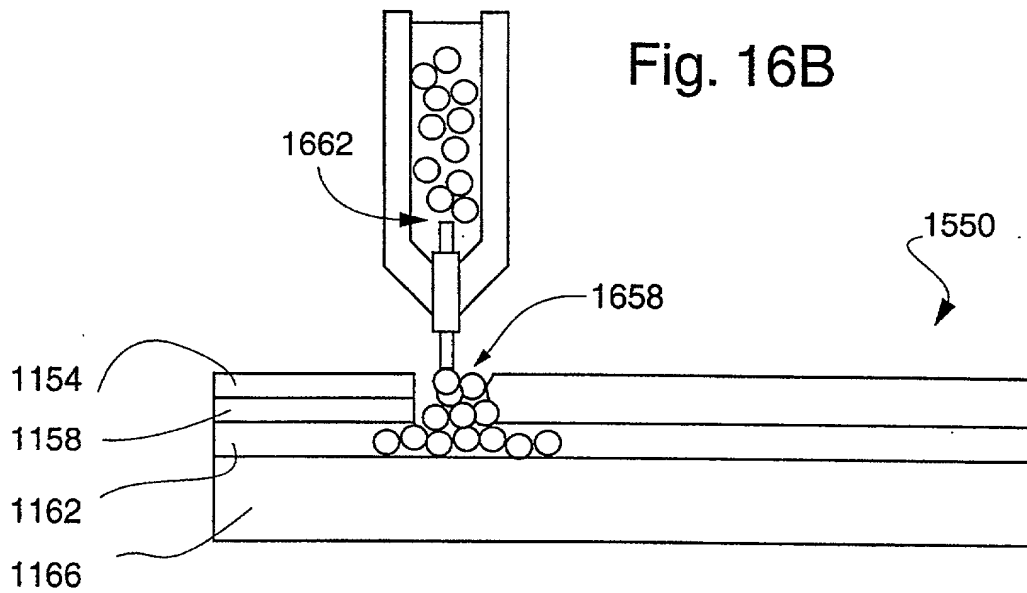


Fig. 16B



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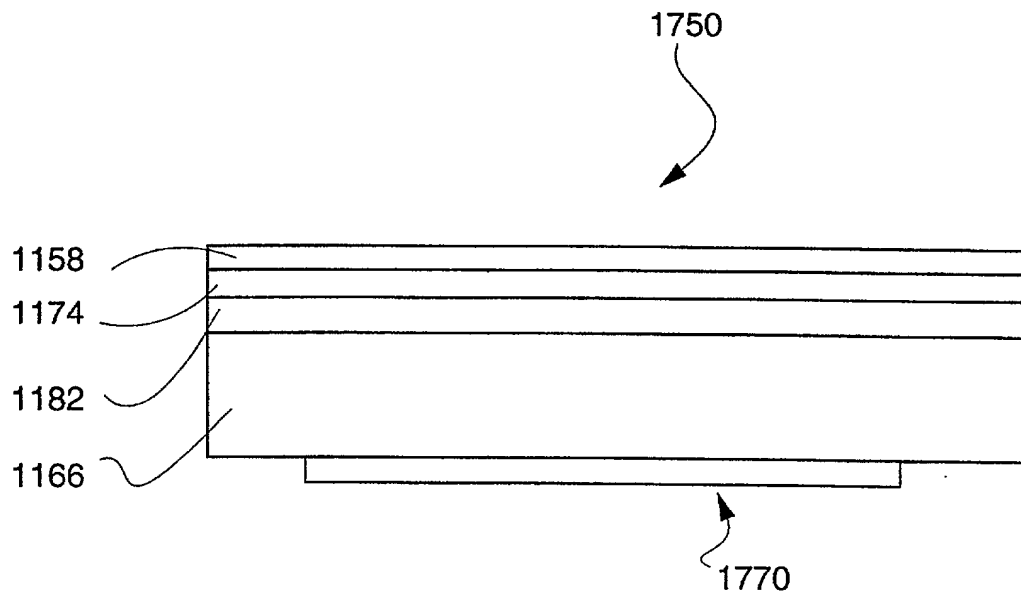


Fig. 17A

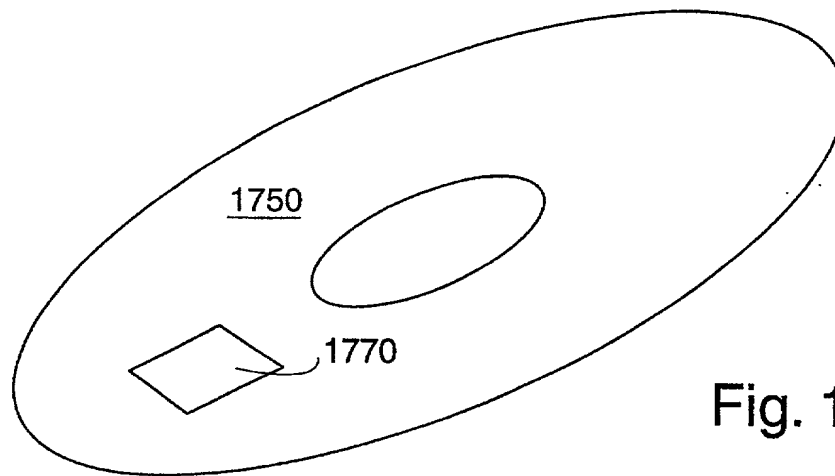
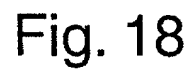


Fig. 17B

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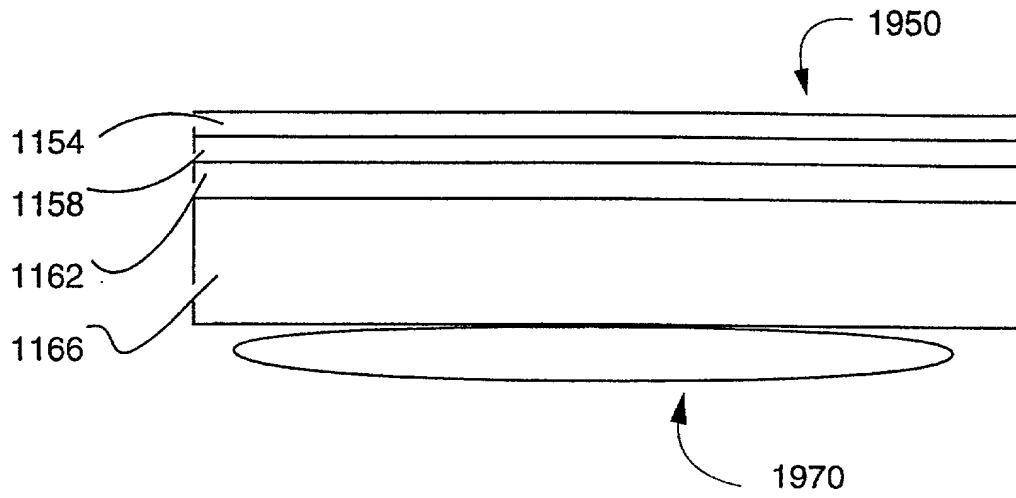


Fig. 19A

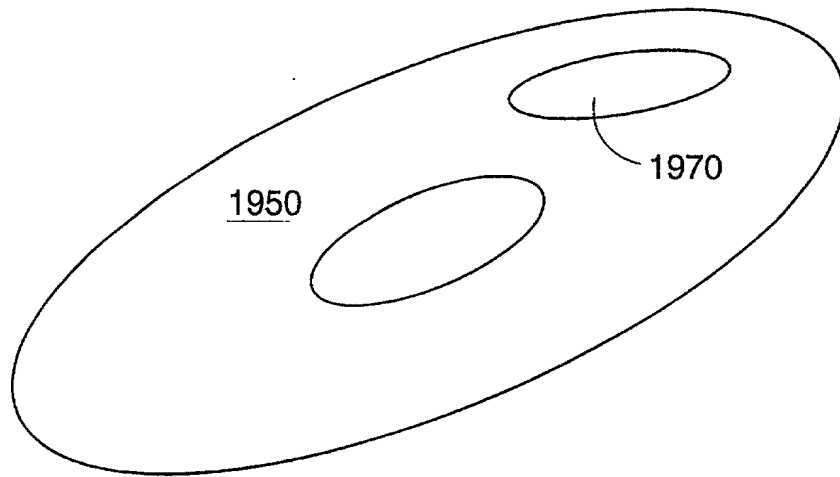


Fig. 19B

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09/646 141

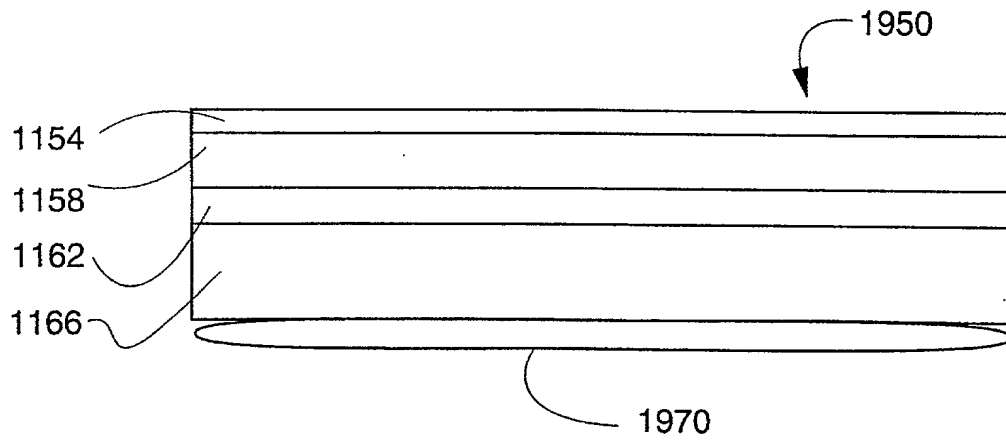
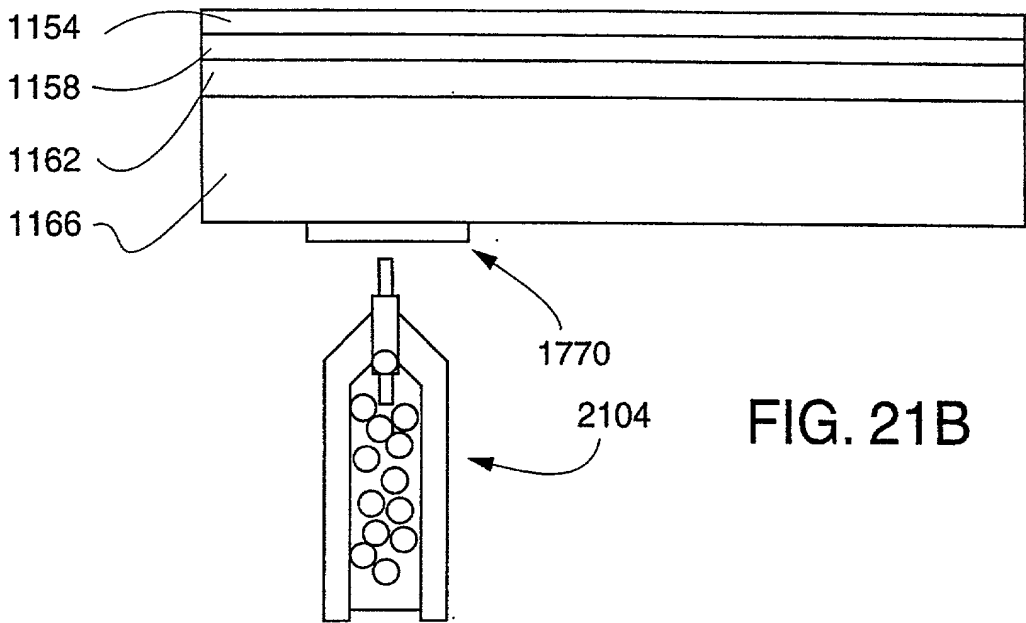
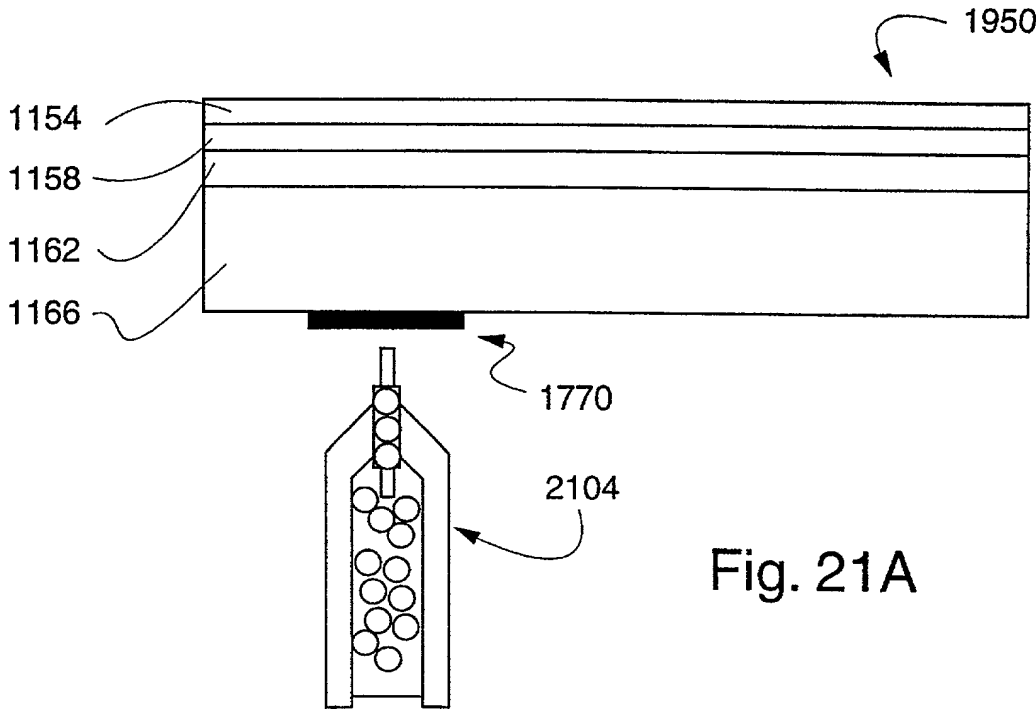


Fig. 20



09/646/41

18/19



19/19

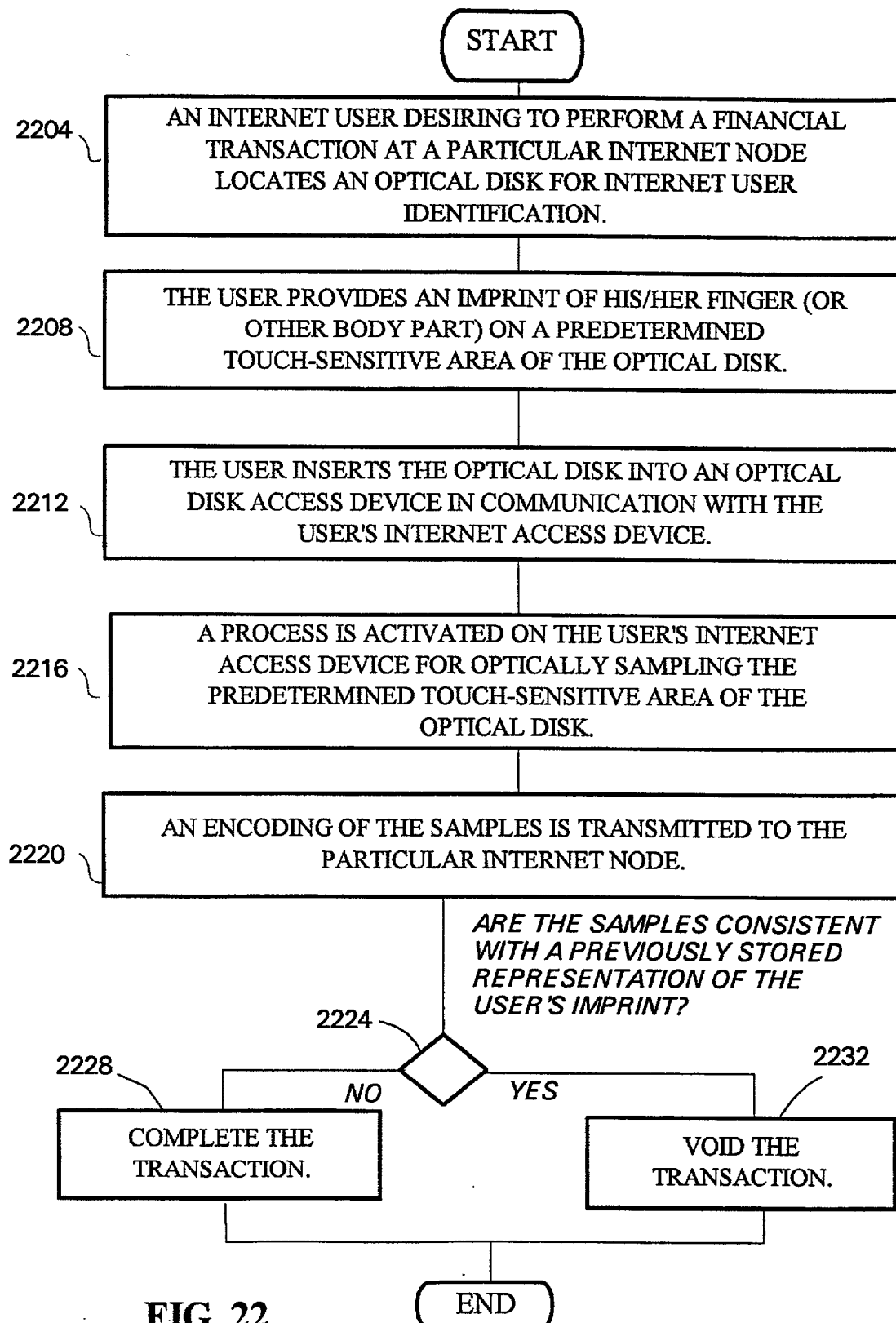


FIG. 22

SUBSTITUTE SHEET (RULE 26)

FROM

(TUE)08:01'00 12:02/ST. 12.00/NO. 3561892125 P 7

PTO/SB/01 (8-95)

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Type a plus sign (+) inside this box ☐

Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

DDPTO Rev. 8/95	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket Number 3699-2-PUS
<b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION</b>		First Named Inventor MCLAUGHLIN, Mark
<b>COMPLETE IF KNOWN</b>		
<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing		<input type="checkbox"/> Declaration Submitted after Initial Filing
Application Number		
Filing Date		
Group Art Unit		
Examiner Name		

As below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed for which a patent is sought on the invention entitled:

**"COPY PROTECTABLE OPTICAL MEDIA DEVICE AND METHODOLOGY THEREFOR"**

(Title of the Invention)

the specification of which

☐ Is attached hereto

OR

☒ was filed on  
(MM/DD/YYYY)

05 June 1997

as United States Application Number or PCT International

Application Number

PCT/US87/08842

and was amended on  
(MM/DD/YYYY)

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification including the claims, as amended by any amendment specifically referred above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				Yes	No
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below

Application Number(s)	Filing Date (MM/DD/YYYY)		Additional provisional application numbers are listed on a supplemental priority sheet attached hereto.
90/040,724	March 14, 1997	<input type="checkbox"/>	

Standard Hour Statement: This form is estimated to take 4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231.

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FROM

(TUE)08.01'00 12.03/ST. 12:00/NO. 3561892125 P 8

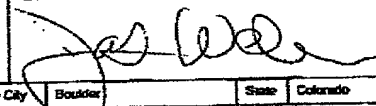
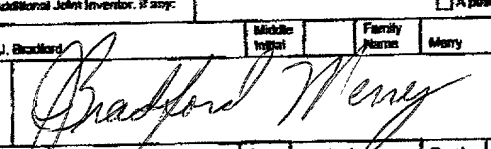
Type a plus sign (+) inside this box. ☐

DECLARATION		Page 2	
<p>I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code § 112.1 acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.</p>			
U.S. Patent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
<input type="checkbox"/> Additional U.S. or PCT International application numbers are listed on a supplemental priority sheet attached hereto.			
As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.			
<input checked="" type="checkbox"/> Firm Name OR <input type="checkbox"/> List attorney(s) and/or agent(s) name and registration number below:		Customer Number or label	
SHERIDAN ROSS P.C.			
Name	Registration Number	Name	Registration Number
ZINGER, DAVID F.	29,127	STANISH, SABRINA CROWLEY	33,374
GROBETH, CRAIG C.	31,713	HANSEN, LEWIS D.	38,536
TOMPKINS, MICHAEL L.	30,880	KOVARIK, JOSEPH E.	33,005
BLAKELY, TODD P.	31,328	SWARTZ, DOUGLAS W.	37,739
CONNELL, GARY J.	32,020	KUGLER, BRUCE A.	38,942
CROOK, WANNELL M.	31,071	BRUNELLI, ROBERT R.	38,617
<input checked="" type="checkbox"/> Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto.			
Please direct all correspondence to:		<input type="checkbox"/> Customer Number or label	OR <input type="checkbox"/> Fill in correspondence address below
Name: JOSEPH E. KOVARIK			
Address: 1500 BROADWAY, SUITE 1200			
City: DENVER		State: COLORADO	Zip: 80202-5147
Country: UNITED STATES OF AMERICA	Telephone: (303) 663-9700	Fax: (303) 663-0223	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.			
Name of Sole or First Inventor:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name	Mark	Middle Initial	Family Name
			McLaughlin
Inventor's Signature		Date	Suffix e.g. Jr.
Residence City	Baton Rouge	State	Louisiana
Country	USA	Citizenship	USA
Post Office Address		5514 S. Palmer Court	
Post Office Address			
City	Baton Rouge	State	Louisiana
Zip	70808	Country	USA
Applicant Authority			
<input checked="" type="checkbox"/> Additional Inventors are being named on supplemental sheet(s) attached hereto.			

FROM

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DECLARATION										ADDITIONAL INVENTOR(S) Supplemental Sheet	
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name	Middle Initial	S.	Family Name	Last Name	Initials	Suffix e.g. Jr.					
Inventor's Signature						Date					
Residence City	Cupertino	State	California	Country	USA	Citizenship	USA				
Post Office Address	18952 Barnack Drive										
Post Office Address											
City	Cupertino	State	California	Zip	95019	Country	USA	Applicant Authority			
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name	Middle Initial	S.	Family Name	Last Name	Initials	Suffix e.g. Jr.					
Inventor's Signature						Date					
Residence City	Littleton	State	Colorado	Country	USA	Citizenship	USA				
Post Office Address	5690 W. Rowland Ave.										
Post Office Address											
City	Littleton	State	Colorado	Zip	80120	Country	USA	Applicant Authority			
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name	Middle Initial	S.	Family Name	Last Name	Initials	Suffix e.g. Jr.					
Inventor's Signature						Date	8/2/00				
Residence City	Boulder	State	Colorado	Country	USA	Citizenship	USA				
Post Office Address	5804 S. Boulder Road										
Post Office Address											
City	Boulder	State	Colorado	Zip	80303	Country	USA	Applicant Authority			
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name	Middle Initial	S.	Family Name	Last Name	Initials	Suffix e.g. Jr.					
Inventor's Signature						Date	8/10/2000				
Residence City	Annapolis	State	Maryland	Country	USA	Citizenship	USA				
Post Office Address	83 Gentry Court										
Post Office Address											
City	Annapolis	State	Maryland	Zip	21403	Country	USA	Applicant Authority			
<input checked="" type="checkbox"/> Further applicants and/or (former) inventors are indicated on another continuation sheet Form PCT/RO/101 (continuation sheet) (July 1998) (form duplicated by Sheridan Ross P.C. - jrm)											

See Notes to the request form

JUL 08 01:00 12 02/ST 12 00/NO 3531892125 P 7

FROM

PTO/SB/01 (8-95)

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Patent and Trademark Office U.S. DEPARTMENT OF COMMERCE

DOP/TO Rev. 6/95  <b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION</b>  <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing    OR <input type="checkbox"/> Declaration Submitted after Initial Filing	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket Number	3899-2-PLS
		First Named Inventor	MCLAUGHLIN, Mark
		COMPLETE IF KNOWN	
		Application Number	
		Filing Date	
		Group Art Unit	
		Examiner Name	

As below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original first and joint inventor (if plural names are listed below) of the subject matter which is claimed for which a patent is sought on the invention entitled:

"COPY PROTECTABLE OPTICAL MEDIA DEVICE AND METHODOLOGY THEREFOR"

(Title of the invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on  
(MM/DD/YYYY)

05 June 1997

as United States Application Number or PCT International

Application Number

PCT/US97/38842

and was amended on  
(MM/DD/YYYY)

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations § 1.56

I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate or § 385(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				Yes	No
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code § 119(a) of any United States provisional application(s) listed below

Application Number(s)	Filing Date (MM/DD/YYYY)		
60/040,724	March 14, 1997	<input type="checkbox"/>	Additional provisional application numbers are listed on a supplemental priority sheet attached hereto

Burden Hour Statement: This form is estimated to take 4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231.

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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

DO/PTO Rev. 6/95	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket Number 3699-2-PUS	
<b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION</b>		First Named Inventor MCLAUGHLIN, Mark	
		<b>COMPLETE IF KNOWN</b>	
		Application Number	
		Filing Date	
		Group Art Unit	
<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing	OR	<input type="checkbox"/> Declaration Submitted after Initial Filing	Examiner Name

As below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed for which a patent is sought on the invention entitled:

**"COPY PROTECTABLE OPTICAL MEDIA DEVICE AND METHODOLOGY THEREFOR"**

(Title of the invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on  
(MM/DD/YYYY)

05 June 1997

as United States Application Number or PCT International

Application Number

PCT/US97/38842

and was amended on  
(MM/DD/YYYY)

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				Yes	No
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below

Application Number(s)	Filing Date (MM/DD/YYYY)		
60/040,724	March 14, 1997	<input type="checkbox"/>	Additional provisional application numbers are listed on a supplemental priority sheet attached hereto.

Burden Hour Statement: This form is estimated to take 4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231.

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FROM

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DECLARATION				Page 2	
I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code § 112.1 acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application					
U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)		
<input type="checkbox"/> Additional U.S. or PCT International application numbers are listed on a supplemental priority sheet attached hereto.					
As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:					
<input checked="" type="checkbox"/> Firm Name OR <div style="border: 1px solid black; padding: 2px; display: inline-block;">SHERIDAN ROSS P.C.</div>		Customer Number or label <div style="border: 1px solid black; width: 150px; height: 20px; margin-top: 2px;"></div>			
<input type="checkbox"/> List attorney(s) and/or agent(s) name and registration number below:					
Name	Registration Number	Name	Registration Number		
ZINGER, DAVID F.	29,127	STAVISH, SABRINA CROWLEY	33,374		
GROSETH, CRAIG C.	31,713	HANSEN, LEWIS D.	35,536		
TOMPKINS, MICHAEL L.	30,380	KOVARIK, JOSEPH E.	33,005		
BLAKELY, TODD P.	31,328	SWARTZ, DOUGLAS W.	37,739		
CONNELL, GARY J.	32,020	KUGLER, BRUCE A.	38,942		
CROOK, WANNELL M.	31,071	BRUNELLI, ROBERT R.	39,617		
<input checked="" type="checkbox"/> Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto					
Please direct all correspondence to:		<input type="checkbox"/> Customer Number or label	OR <input type="checkbox"/> Fill in correspondence address below		
Name		JOSEPH E. KOVARIK			
Address		1500 BROADWAY, SUITE 1200			
Address					
City	DENVER	State	COLORADO	Zip	80202-5141
Country	UNITED STATES OF AMERICA	Telephone	(303) 863-9700	Fax	(303) 863-0223
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.					
Name of Sole or First Inventor:		<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name	Mark	Middle Initial	Family Name	Suffix (e.g., Jr.)	
			McLaughlin		
Inventor's Signature			Date		
Residence City	Baton Rouge	State	Louisiana	Country	USA
Post Office Address	5514 S. Palmer Court				
Post Office Address					
City	Baton Rouge	State	Louisiana	Zip	70806
Country	USA	Applicant Authority			
<input checked="" type="checkbox"/> Additional inventors are being named on supplemental sheet(s) attached hereto.					

(TUE) 08 01' 00 12.03/S7. 12:00/NO. 3561892125 P 10

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<b>DECLARATION</b>				<b>ADDITIONAL INVENTOR(S) Supplemental Sheet</b>			
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name	Karl	Middle Initial	R.	Family Name	Schneck, Jr.	Suffix e.g. Jr.	
Inventor's Signature					Date	10 Aug 00	
Residence City	Milford	State	Pennsylvania	Country	USA	Citizenship	USA
Post Office Address	3099 Sunrise Lake						
Post Office Address							
City	Milford	State	Pennsylvania	Zip	18337	Country	USA
						Applicant Authority	

Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor					
Given Name		Middle Initial		Family Name		Suffix e.g. Jr.	
Inventor's Signature					Date		
Residence City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor					
Given Name		Middle Initial		Family Name		Suffix e.g. Jr.	
Inventor's Signature					Date		
Residence City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor					
Given Name		Middle Initial		Family Name		Suffix e.g. Jr.	
Inventor's Signature					Date		
Residence City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor					
Given Name		Middle Initial		Family Name		Suffix e.g. Jr.	
Inventor's Signature					Date		
Residence City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	
[ ] Further applicants and/or (further) inventors are indicated on another continuation sheet							



PTO/SB01 (8-95)

Approved for use through 10/31/98 OMB 0651-0032

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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

COMPTON Rev. 8/95  <b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION</b>  <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing      OR <input type="checkbox"/> Declaration Submitted after Initial Filing	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket Number	3690.2 PUS
		First Named Inventor	MCLAUGHLIN, Mark
	COMPLETE IF KNOWN		
	Application Number		
	Filing Date		
	Group Art Unit		
		Examiner Name	

As below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed for which a patent is sought on the invention entitled:

**"COPY PROTECTABLE OPTICAL MEDIA DEVICE AND METHODOLOGY THEREFOR"**

(Title of the invention)

the specification of which

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Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority has Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code § 119(c) of any United States provisional application(s) listed below

Application Number(s)	Filing Date (MM/DD/YYYY)		
50060,724	March 14, 1997	<input type="checkbox"/>	Additional provisional application numbers are listed on a supplemental priority sheet attached hereto.

Read the Instructions. This form is intended to take 4 hours to complete. Time will vary depending upon the needs of the individual case. Any statements on the front of this form you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231.

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Received: 8:22:03 11:22:

303543 7313 =&gt; MCCASKILL ; #5

Wednesday, August 02, 2000 11:37 AM

James Weldon 303543 7313

p 05

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(TUS)08.01'00 12:03/87. 12:00/NO. 3561892125 P 8

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DECLARATION		Page 2	
<p>I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(a) of any PCT international application designating the United States of America, filed before and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code § 112.1 acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which becomes available between the filing date of the prior application and the national or PCT international filing date of the application.</p>			
U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
<input type="checkbox"/> Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.			
As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to conduct all business in the Patent and Trademark Office connected therewith:			
<input checked="" type="checkbox"/> First Name OR <b>SHERIDAN ROSS P.C.</b> Customer Number or label			
<input type="checkbox"/> List attorney(s) and/or agent(s) name and registration number below:			
Name	Registration Number	Name	Registration Number
ZINGER, DAVID F.	29,127	STAVISH, SABRINA CROWLEY	33,374
GROSETH, CRAIG C.	31,733	HANSEN, LEWIS D.	35,538
TOMPKINS, MICHAEL L.	30,980	KOVARIK, JOSEPH E.	33,005
SLAKELY, TODD P.	31,326	SWARTZ, DOUGLAS W.	37,739
CONNELL, GARY J.	32,020	KUGLER, BRUCE A.	38,942
CROOK, WANNELL M.	31,071	BRUNELLI, ROBERT R.	39,617
<input checked="" type="checkbox"/> Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto			
Please direct all correspondence to: <input type="checkbox"/> Customer Number or label		OR <input type="checkbox"/> Fill in correspondence address below	
Name <b>JOSEPH E. KOVARIK</b>			
Address <b>1380 BROADWAY, SUITE 1200</b>			
City <b>DENVER</b>		State <b>COLORADO</b>	Zip <b>80202-5141</b>
Country <b>UNITED STATES OF AMERICA</b>		Telephone <b>(303) 863-8700</b>	Fax <b>(303) 863-0223</b>
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issued thereon.			
Name of Sole or First Inventor		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name	Mark	Middle Initial	Family Name
			McLaughlin
Inventor's Signature	Date		Suffix e.g. Jr.
<i>Mark T. McLaughlin</i>	9/6/00		
Residence City	Baton Rouge	State	Louisiana LA
Country	USA	Citizenship	USA
Post Office Address	5514 S. Palmer Court		
Post Office Address			
City	Baton Rouge	State	Louisiana
Zip	70808	Country	USA
Applicant Authority			
<input checked="" type="checkbox"/> Additional inventors are being named on supplemental sheet(s) attached hereto.			


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**SECRET**

Type a blue sign (+) inside this box . ☐

DECLARATION										ADDITIONAL INVENTOR(S) Supplemental Sheet									
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor									
Given Name		Middle Initial			Family Name		Lastname			Suffix e.g. Jr.									
Inventor's Signature										Date									
Residence City		Capetown			State		California CA		Country		USA		Citizenship		USA				
Post Office Address		10952 Saravalia Drive																	
Post Office Address																			
City		Capetown			State		California		Zip		95019		Country		USA		Applicant Authority		
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor									
Given Name		Larry			Middle Initial		Family Name		Smith			Suffix e.g. Jr.							
Inventor's Signature										Date		8/3/2007							
Residence City		Littleton			State		Colorado CO		Country		USA		Citizenship		USA				
Post Office Address		5630 W. Rowland Ave.																	
Post Office Address																			
City		Littleton			State		Colorado		Zip		80120		Country		USA		Applicant Authority		
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor									
Given Name		James			Middle Initial		Family Name		Walden			Suffix e.g. Jr.							
Inventor's Signature										Date									
Residence City		Boulder			State		Colorado CO		Country		USA		Citizenship		USA				
Post Office Address		6424 S. Boulder Road																	
Post Office Address																			
City		Boulder			State		Colorado		Zip		80303		Country		USA		Applicant Authority		
Name of Additional Joint Inventor, if any:										<input type="checkbox"/> A petition has been filed for this unsigned inventor									
Given Name		J. Bradford			Middle Initial		Family Name		Mary			Suffix e.g. Jr.							
Inventor's Signature										Date									
Residence City		Annapolis			State		Maryland MD		Country		USA		Citizenship		USA				
Post Office Address		63 Gentry Court																	
Post Office Address																			
City		Annapolis			State		Maryland		Zip		21403		Country		USA		Applicant Authority		
[X] Further applicants and/or (further) inventors are indicated on applicant collaboration sheet																			

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**See Notes to the request form**

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Type a plus sign (+) inside this box: ☐

DECLARATION				ADDITIONAL INVENTOR(S) Supplemental Sheet			
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name	Kurt	Middle Initial	R.	Family Name	Schweck, Jr.	Suffix	e.g. Jr.
Inventor's Signature					Date		
Residence City	Milford	State	Pennsylvania	Country	USA	Citizenship	USA
Post Office Address	3099 Sunrise Lake						
Post Office Address							
City	Milford	State	Pennsylvania	Zip	18307	Country	USA
				Applicant Authority			

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name		Middle Initial		Family Name		Suffix	e.g. Jr.
Inventor's Signature					Date		
Residence City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	
				Applicant Authority			

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name		Middle Initial		Family Name		Suffix	e.g. Jr.
Inventor's Signature					Date		
Residence City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	
				Applicant Authority			

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name		Middle Initial		Family Name		Suffix	e.g. Jr.
Inventor's Signature					Date		
Residence City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	
				Applicant Authority			

[ ] Further applicants and/or (inventor) inventors are indicated on another continuation sheet.

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See Notes to the request form

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